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A
MANUAL OF JAIL HYGIENE

FOR THE USE OF

MEDICAL SUBORDINATES,

BY

MAJOR W. J. BUCHANAN, B.A., M.B., B.CH., D.S.M.,

INDIAN MEDICAL SERVICE,
SUPERINTENDENT, CENTRAL JAIL, BHAGALPUR.

SECOND EDITION.

Calcutta:
BENGAL SECRETARIAT PRESS.
1900.

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PREFACE.

This little volume is intended for the use and instruction of Medical Subordinates in Bengal Jail Hospitals. In my experience I have met with many hardworking, attentive subordinates of this class, and have found that while they may faithfully carry out orders given to them, they are often not well acquainted with the reasons why such orders are given; that is to say, their knowledge of hygiene is scanty. It is to try and remedy this that this book has been written. It is probable too that the information in it may help the Medical Subordinate in his septennial promotion examinations.

An Indian jail is, I often think, about the only place in this country where a sanitarian has a free hand, and where he can really act up to the theories he professes.

I have endeavoured before all to be practical. There is little or nothing recommended in this book which I have not been able, in one or other of the jails I have had charge of, to actually carry out, and the more care and attention that is given to sanitary details in a jail, the better the health of the prisoners will be. As the executive sanitary officer of a jail, it behoves the Medical Subordinate to be acquainted with sanitary science, and at present no satisfactory text-book on Indian Hygiene is available. If this volume will lead to a better understanding of jail hygiene, it will not have been written in vain.

The work has little pretence at being original. I have refrained from generally quoting authorities. Those who know their Parkes' "Hygiene" will see the influence of that classic work on every page. The new Bengal Jail Code has of course been freely used and quoted from. In conclusion, I have to thank Surgeon-Lieutenant-Colonel D. W. D. Comins, Inspector-General of Jails, Bengal, for his valuable advice and criticism of this little work.

Plague Camp, Chausa, *January 1898.*

W. J. BUCHANAN, M.B.,
Surgeon-Captain, I.M.S.

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PRESS OPINIONS ON FIRST EDITION.

1

The little book published by Surgeon-Captain W. J. Buchanan for the use of Medical Subordinates is to be cordially welcomed: it is an admirable little book .... After reading this book the Subordinate should not only be able to carry out the orders of the Medical Officer, but to know why those orders are given.

("Lancet," *June 11th, 1898.*)

2

The idea is admirably carried out, and the information conveyed on such important subjects as ventilation, food, clothing, conservancy, water-supply, disinfection, the management of infective diseases, etc., is detailed and accurate, and conveyed in clear and simple language. Particular diseases, such as cholera, plague, enteric fever, malarial fever, diarrhœa, dysentery, etc., are briefly described, and the most recent views regarding their causation and prevention stated. ...... The Manual cannot fail to be most helpful and improving to the class of officers for whose benefit it has been composed, and, indeed, to all jail officials in India.

("British Medical Journal," *September 24th, 1898.*)

3

We have no hesitation in saying that Surgeon-Captain Buchanan's Manual meets a distinct want. In a small compass it deals with all important matters relating to the health and comfort of prisoners, and is full of excellent advice and direction, which is thoroughly practical and which will prove useful not only to Medical Subordinates, but also to Medical Officers connected with jails. We see that it is specially written for Indian jails, but the principles laid down apply equally well to all jails in the tropics, and we hope that Dr. Buchanan's book will secure this wider circulation.

("Journal of Tropical Medicine," *August 1898.*)

4

It is essentially a practical work, just such as might be expected from an officer who has earned a brilliant reputation for successful jail management . . . It is a work which should prove of immense value to Medical Subordinates in the Jail Department, and we shall be surprised if it does not find its way into the jails of the other provinces of India.

("Indian Medical Gazette," *June 1898.*)

5

The Secretary to the Howard Society, London, wrote as follows:—

"Your *Manual of Jail Hygiene* is an excellent work, and there ought to be a similar one for English jails. You have rendered a great service both to India and to humanity by that work and by your carrying out its principles into practice. The Committee desired me to convey to you their thankful appreciation of your important services to humanity."

(*Letter dated 8th July 1898.*)

6

The Surgeon-General with the Government of India writes as follows in his annual note on Indian jails for 1898:—

"Before passing on to the notes on the most important features of the vital statistics of the different provinces, I would commend to the attention of all connected with the conduct of the work in jails an excellent *Manual of Jail Hygiene*, which compiled, as it is, by an experienced Jail Officer, Captain W. J. Buchanan, I.M.S., will amply repay perusal."

PREFACE TO SECOND EDITION.

A SECOND edition of this little book having been called for, it was found necessary to revise some of the chapters, especially that on Malaria. On page 102 will be found a simple outline of the new theory of mosquito malaria—a subject which was only hinted at when the first edition was written. The extermination of the mosquito is now being attempted in many malarious localities; it has certainly most chance of being successfully and thoroughly carried out inside a jail. Therefore it behoves the Jail Medical Officer and his Subordinates to make the attempt. The other additions and alterations in this edition will be found in the chapters on ventilation, scurvy, dysentery, &c., and many others of minor importance.

I have to thank Lieutenant-Colonel E. Lawrie, I.M.S., of Hyderabad, for the Appendix on "How to give Chloroform," which, I feel sure, will be found useful to the Medical Subordinates for whom this book has been written.

CENTRAL JAIL, BHAGALPUR,
September 1900.

W. J. BUCHANAN, M.B.,
Major, I.M.S.

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A MANUAL OF JAIL HYGIENE.

CHAPTER I.

The duties of the Medical Subordinate* in a Bengal jail are laid down in the Jail Code, paragraphs 88—116, etc. These rules should be carefully studied and observed by all Medical Subordinates in charge of jail hospitals.

It will be seen that the duties of this officer differ in many important respects from those of a Medical Subordinate in charge of a dispensary or public hospital. Under the Medical Officer of the jail he is responsible not only for the suitable medical or surgical treatment of prisoners who are actually ill, but also for the equally important duty of preventing sickness and of maintaining the cleanliness and sanitation of the jail premises and personal hygiene of the prisoners. No Medical Subordinate will be considered to have done his duty or be entitled to commendation who does not actually supervise all the arrangements for the health and comfort of the prisoners. It is a great mistake to suppose that his duties are limited to the hospital; the whole of the jail premises are under his sanitary care. The Medical Subordinate should bear in mind that one of the best tests of his having efficiently performed his duties is in his being able to show a low death-rate: it is of less importance to show a small sick list, for in the anxiety to do this, many cases which require hospital treatment might be kept out of hospital. As regards death-rate, the jails of Bengal have now surpassed the standard laid down many years ago by Dr. Mouat when Inspector-General of Jails, Bengal, viz., 30 per mille. This is of course an average for all Bengal, and it is a rate which we may hope in the near future to see permanently reduced. Some jails are more unhealthy than others owing to various causes, the most important of which are (1) the state of the general health of the district and of the year or season, and (2) also some jails are better constructed than others, that is, their sanitary arrangements are better; but it must be remembered that good work in the case of the sick and in attention to the sanitary regulations of the Jail Code on the part of the Medical Subordinate is always of value, and will always be seen in the better health of the prisoners.

---

* The term "Medical Subordinate" means an Assistant Surgeon, Apothecary or Civil Hospital Assistant.—*Jail Code*, paragraph 88.

One of the first duties of the Medical Officer of a jail is to pass the newly-admitted prisoners, and to record on their history tickets his opinion as to their present health and their present fitness for labour. Jail labour is of three forms, viz., hard, medium, and light, and the Medical Officer must state which form of labour he considers a prisoner fit for (*vide* Jail Code, 79).

Though this is not properly a part of the Medical Subordinate's duties, yet it is useful for him to understand the considerations which are usually in the mind of the Medical Officer when making these entries.

The Medical Officer notes the appearance of the prisoner as the latter stands before him clad only in his cotton *janghias*. He compares the recorded weight with the recorded height. If the weight approximates to that given in the formula explained below, the man will usually be found in good health;* if above this, it is usually so much the better; if below this standard, it will usually be found that the man is not in his best health, has been underfed perhaps, or has been or is ill. Men whose weight is not up to this average

---

* The following rule is intended to give an *approximate* standard for relative height and weight. It is not meant to be accurately applied to every individual case, but it is believed that it will be a guide in determining what a man's normal weight ought to be. It only applies to Bengal and Bihar male adults from 25 to 45 years of age. It does not apply to hillmen, certain aboriginal tribes, to Burmese, nor inhabitants of the North-Western Provinces or Punjab.

The following formula is easily remembered:—"Taking 100 lbs. to be an approximate standard weight for a man of 5 feet high, add 3 lbs. for each inch will generally be found to be unfit for the severer forms of hard labour.

The Medical Officer next looks for evidences of inferior health. This can often be seen in the face. A worn tired expression, pale lips, pale or yellow conjunctivæ, want of fat or fulness in the cheeks, a puffy condition of the eyelids, sometimes an ashy colour of the skin, prematurely grey hair (the latter is often dyed black). A glance at the thorax will show whether there are hollows under the clavicles, whether the ribs stand out distinct, or are well covered with flesh, or palpitation of the heart may be noted or displacement of the apex beat. Marks or scars on the skin are also looked for, as they often indicate past disease, being often marks of rough forms of treatment practised by country *baids* and *kabirajs*. The condition of the teeth and gums should be noted; the teeth may have fallen out owing to old age, scurvy or improper use of mercurials. Another glance at the prisoner's limbs will show signs of ulcers or varicose veins, or dropsy and œdema from various causes. Enquiries are also made as to presence or absence of hydrocele, hernia, or any form of venereal disease.

Next, the age of the prisoner is to be determined, as little or no reliance is to be placed upon the prisoner's own statement as to his age, so few people of this class knowing it.

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above that height up to 5 feet 7 inches. For 5 feet 8 and over add 4 lbs. per inch—"

e.g., A man of 5 feet 2 should weigh about 106 lbs.
" of 5 " 6 " " 118 "
" of 5 " 8 " " 133 "
&c.

(*Vide* Inspector-General of Jails' Circular No. 19 of 1895.)

The above formula is based upon a collection of over 28,000 weighments and measurements, and is almost exactly the same as the combined results of a collection of some 7,000 measurements in seven central jails—*vide* Administration Report for 1896.

Also *vide Lancet*, vol. 2, 1897, and *Indian Medical Gazette*, October 1897, and Appendix V, below, page 135. This table has been found to apply to prisoners in the Central Provinces, and a physical equivalent table, drawn up by Major Andrew Buchanan, I.M.S., is there used for this purpose.

It is difficult to lay down definite rules for determining the age of an individual, but the following points are usually taken into account:—the shape of the angle of the lower jaw, which becomes more and more of a right angle as the individual approaches manhood, the presence or absence of beard and moustache or signs of shaving, the colour of the hair (the latter is frequently dyed by elderly men). The *arcus senilis* or grey ring round the outer edge of the cornea may be seen in elderly men. In them also the skin of the face will usually be wrinkled or in loose folds. These and other points are rapidly considered in determining an individual's age. It is of most importance to enter as correctly as possible the ages of the following classes of prisoners:—(1) boys under 12, who are not usually considered in law responsible for their actions; (2) boys under 16, who may have to be sent to a reformatory; (3) adolescents from 17 to 22, who should, where possible, be kept separate from the older prisoners; and (4) old men, over 45 years of age, who are on account of age unfit for transfer to central jails for hard work or to the Andamans if transportation prisoners.

Another duty which particularly falls to the Medical Subordinate of a jail is the detection of communicable disease present or recent among newly-admitted prisoners, or in the 'under-trial' ward. The most common diseases to be looked for among these prisoners are small-pox, chicken-pox, mumps, measles, and itch; cholera or plague also may be admitted in this way. It is most important to detect the existence of such diseases at once, for though several of them are not a source of much danger, yet when once a disease, such as mumps or chicken-pox, gets established among the prisoners of a jail, it is difficult to stamp it out. If in doubt about any particular case being infectious, the golden rule should be to treat it as if it were such. It is much better that a suspected individual should be isolated unnecessarily for a few days than that infectious disease should be admitted a footing within the jail. If therefore such a case is found or suspected, the

Medical Subordinate must at once inform the Jailor, who should at once take steps to ensure isolation of the affected prisoner as thoroughly as the construction or available space in the jail will admit, and in time of the epidemic prevalence of any of the above diseases in the neighbouring town or district, it should be a rule to at once segregate all new-comers for a week or 10 days, or as long as the segregation space available will admit. All such cases should be shown to the Medical Officer at his next visit, or in case of cholera, plague or small-pox, notice at once should be sent to that officer. The clothing, etc., of such prisoners, whether private or jail, must be at once disinfected or destroyed by fire, and the value, if private, noted on the prisoner's warrant.* The subject of infectious diseases and disinfection will be fully discussed below (Chapter XIII, page 80).

The Medical Subordinate must also note the presence of any wounds or injuries on the persons of newly-admitted prisoners or under-trials. Such cases should be brought to the notice of the Medical Officer, as they are often of medico-legal importance.

When a prisoner is noted as in indifferent or bad health, the cause of this condition should be briefly stated on the history ticket (*e.g.*, anæmia, emaciation, spleen, etc.).

CHAPTER II.

VACCINATION.

THE Jail Code (rule 453) lays down that "all convicted prisoners, whether protected or not, shall be vaccinated as soon as convenient after arrival in jail, and the operation shall be repeated whenever it may appear necessary."†

If a prisoner received on transfer from another jail has been recently *successfully* vaccinated, it is left to the discretion of the Medical Officer to revaccinate him or not. In such cases, however, unless the marks of vaccination are distinct and recent, and the fact of successful vaccination is noted upon the prisoner's ticket, it is better to treat him as unprotected and vaccinate him as soon as possible.

---

* As a regular practice the private clothing of all newly-admitted prisoners should be boiled and washed outside before being stored in the godown.

† It is also the duty of the Medical Subordinate to see that all warders are properly vaccinated on appointment. The fact should also be noted in their service-books.

It will frequently be found that prisoners bearing distinct marks of vaccination (in early years), of inoculation, and even of small-pox are easily re-vaccinated with complete success, owing to the protection afforded by the above having disappeared on account of a long period having elapsed since they were protected. It is a fact which cannot be questioned that the more marks an individual bears of successful vaccination, the less are his chances of being attacked by small-pox; and as in all countries revaccination at the age of puberty (*i.e.*, in addition to vaccination in infancy) has been found necessary, it is most desirable that this should be thoroughly done in jails, where large numbers of individuals are congregated together. The prisoner's own statement of his having suffered from small-pox outside is never to be accepted as an excuse for the non-performance of vaccination inside jail. The Medical Subordinate knows that chicken-pox and many harmless skin diseases are confused with small-pox by the ignorant peasantry.

OPERATION OF VACCINATION.

This operation, though simple, is never to be carelessly done, and must be done by the Medical Subordinate himself or other licensed vaccinator. In some jails it is the practice to get the local municipal vaccinator to perform the operation upon the prisoners. There is no objection to this practice, but the Medical Subordinate should himself thoroughly understand how it is done, and is responsible for its proper performance. On no account should a prisoner, however skilful, be allowed to vaccinate.

In Bengal jails two forms of vaccine (lymph) are usually available, viz., lanolin paste lymph, or calf lymph. The use of human lymph (arm-to-arm vaccination) is to be discouraged. In any case it should only be used in a jail in urgent cases when either the lanolin paste or calf lymph is temporarily unable to be procured.

The lanolin lymph is procured on indent at regular intervals from the animal vaccine depôts in Calcutta or Darjeeling (Ghoom), but where it is possible, it is best to keep up in the jail a supply of lymph direct from the calves, though it is only in the central jails that the number of calves is large enough to keep up sufficient for the whole year. In all jails, however, an endeavour might be made to use all the calves available in the jail dairy. This will provide lymph for some portion of the year.

Calf lymph is procured as follows:—a young calf is taken; it is laid upon its back upon the ground and held in this position by three or four men; next the under surface of the abdomen between the hind legs is thoroughly washed with warm water and soap. The surface of the skin of this part is then shaved clean with a razor, and upon the clear white skin a number of points of lymph are inserted at intervals of about one inch. Twenty-five or thirty points will be sufficient. These spots are allowed to dry, and a clean cloth is tied around the part. The calf is kept apart from others; if still sucking, its mother may be tied up alongside it.

On the fifth day, inclusive, if the inoculation is going to be successful, numerous small vesicles will be seen full of clear lymph at each puncture spot. These are ready for use. Before collecting the lymph this surface must be carefully and lightly washed with soap and warm water, and the surface gently dried with a clean towel. The lymph may now be used in two ways—either all may be collected in a small porcelain vessel and mixed with lanoline* for preservation. or the lymph may be taken up directly on the point of a perfectly clean lancet or scarifier, and inserted in two or four points into the arms of the prisoners awaiting vaccination. To do this the skin over the prominence of the deltoid muscle, just below the shoulder, is put on the stretch. If the lancet is used, its point is lightly rubbed over a small area of skin just sufficient to get at the under skin without drawing blood, and the lymph is rubbed in with the flat side of the instrument. This is done in four points, usually two on each arm. If the scarifier is used, the toothed end is scraped along the skin of the same part of the arm for about half-an-inch, and the lymph is taken up with the spear-shaped end of the instrument and gently rubbed into the scratches. Little or no blood should be drawn. Too much force is often used, which is painful as well as unnecessary. The ideal operation can be performed so gently as not to awaken a sleeping child.

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* Lanolin lymph as made in Bengal is usually very successful. Glycerinated lymph is now largely used everywhere, as glycerin has the power of destroying extraneous harmful organisms in lymph, without in any degree impairing the "vaccination" power of the lymph.

After the operation is over each prisoner should sit for about ten minutes, with his arms uncovered to let the spots dry. It is necessary to warn the prisoners not to wipe off the lymph, or in any way touch the spots. The lymph is often wilfully wiped off in bathing. No water, mud or any form of drug is to be applied to the sore.

The Medical Subordinate must keep a careful register of all vaccinations done in the following form :—

Number.	Form of lymph and date of preparation.	Prisoner's number.	Name.	Date of operation.	Number of points.	Date of inspection.	Number of points successful.	Remarks.
1	2	3	4	5	6	7	8	9

These entries must be carefully filled up for each prisoner—columns 1 to 6 at time of operation and columns 7, 8, 9 at date of inspection. In the column for remarks it should be noted whether the prisoner was previously vaccinated,[*] inoculated or had previous small-pox.

All vaccination cases should be inspected regularly on from the seventh to the tenth day after the operation, and the result, *i.e.*, number of successful points noted, and this result must be recorded on the prisoner's ticket.[†]

The following is the usual course of a successful primary vaccination:—

If primary (*i.e.*, in an unprotected person), no particular effect is seen for the first two or three days, then a slight elevation becomes perceptible. This by the fifth day has become a distinct vesicle of a whitish colour with a raised edge and a cup-like centre depression. By the eighth day (inclusive) the vesicle has attained perfect growth: it is round, pearl-coloured, and full of clear lymph. A ring of inflammation, called the *areola*, is beginning, and both vesicle and *areola* spread for a few days. After the tenth day the *areola* begins to fade and the vesicle to dry up, the lymph inside becoming dull and opaque. About the fifteenth day a hard brown scab is formed, which gradually dries up and falls off about the twenty-first day, leaving a permanent scar.

In cases where the scarifier has been used, either one large vesicle is formed or a crop of small vesicles appear along the lines made by the teeth of the instrument. Should the vesicles be rubbed or any stuff applied to them, an ulcerated sore results, which takes a long time to heal up, and erysipelas may start from such sore.

In some cases the course of revaccination is identical with that of primary. In others the only result is a spurious papule or pointed vesicle with a hard irregular *areola*, reaching its height by the fifth or six day, forming a scab by the eighth day, which soon falls off. There is frequently more itching and local irritation after revaccination than after the primary operation.

---

[*] Much of the irritation and suppuration seen in ordinary vaccination is quite unnecessary, and due to presence in the lymph of extraneous organisms, which, if usually harmless, are certainly of no advantage. In some cases a sore may be produced by these organisms without any true "vaccination" being done. This may explain many cases of successful revaccination very soon after a supposed successful vaccination.

[†] The vaccination should be recorded, whether successful or not. It is the *result* of the operation, which it is important to record.

The Sanitary Commissioner, Bengal (circular 369 of 1894), has directed that the term "secondary" vaccination is only to be applied in those cases where the primary operation has failed, and revaccination to the operation on a person who has been successfully vaccinated before.*

CHAPTER III.

WEIGHMENT OF PRISONERS.

EVERY prisoner in the jail shall be weighed once a fortnight on Sunday, and his weight shall be recorded on his history ticket with date, calculated in lb. Properly balanced beam scales (and imperial lb. weights) shall alone be used, as others easily get out of order (Rule 964). This is the duty of the Medical Subordinate, who may be assisted (Rule 111) by a compounder or assistant jailor. Prisoners shall only be weighed in their *jangiahs* and neck ring: consequently in cold weather a warm sunny spot out of the wind must be chosen as the weighing place. The weight of fetters, in case of prisoners wearing such, is to be deducted from the actual weight. Ordinary "link fetters" weigh 3 lbs., bar fetters from 3 to 5 lbs., and cross bar-fetters about 2½ lbs. In ordinary jails it is generally possible to weigh all prisoners on one Sunday morning, but in central jails it may be found convenient to weigh A class prisoners one day and B class that day week, and so on alternately. It has also been found at times useful to weigh prisoners unexpectedly. If the Medical Subordinate has reason to suspect that any prisoners are keeping down their weight by under-feeding to gain special indulgences in food or labour, it is his duty to inform the Medical Officer and Superintendent, who by ordering weighment of all prisoners on some unexpected day will find out what truth there may be in the suspicion, as such prisoners usually only take less food for 24 or 48 hours before weighment. A tally must be kept in a rough note-book, so that the Medical Subordinate can report the number who have lost weight, remained stationary, or have gained. A good plan is adopted in some jails of calculating the percentages of those who have lost, gained or remained stationary since last weighment. By recording this regularly valuable information is gained as to seasonal variations in weight and such like fluctuations. Those losing weight are distinguished according as they have lost, from 1 to 2 lbs., from 3 to 5, and over 5 lbs. The abstract of results, as per Jail Code, Rule 965, must also be ready for the Medical Officer and Superintendent on the day after weighment. It is frequently found that a man loses steadily a small amount each fortnight; such cases should at once be brought before the Medical Officer. All those who have lost over 3 lbs. must be paraded for Medical Officer's inspection. It is directed that the Medical Officer shall form a separate gang of all such as are losing weight, as loss of weight, if continued, will generally be found to be due to more or less latent disease, which it is the primary object of the weighment system to detect. Care should be taken that all convict watchmen, overseers, and warders are weighed along with their gangs.

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* In Bengal it has been customary to stop vaccination during the hot weather, but it will be found possible with care to vaccinate in jails in all months of the year.

The convalescent and special gangs, or any gang on special diet, must be weighed weekly, and a list of these with their weights from week to week should be kept for use of Medical Officer and the Superintendent.

The usual causes of persistent loss of weight are dyspepsia, diarrhœa, "night fever," anæmia or commencing tubercle of the lungs. It is by catching such cases early that good can be done, and the weighment system is a most valuable aid in this direction.

CHAPTER IV.

Ventilation of Barracks and Buildings.

The Jail Code lays down the sanitary regulations in force with regard to this subject (Jail Code, 930, etc.)—

"In every sleeping ward superficial and cubical space shall be allowed for each prisoner, as stated below, according to the conditions specified":—

	Superficial area per prisoner.	Cubic air space per prisoner.
1	2	3
	Square feet.	Cubic feet.
In healthy non-malarious places where only two rows of prisoners sleep in the ward between the ventilating openings.	36	540
In unhealthy or malarious districts where the wards are raised from 12 to 14 feet from the ground and only two rows of prisoners sleep in the ward.	36	540
In unhealthy districts where the prisoners sleep within 12 feet off the ground and only in two rows.	50	750
In wards in which prisoners sleep in four rows.	50	750
In wards in which prisoners sleep in more than four rows.	100	1,200

In jail hospitals the allowance of space shall not be less than 54 square feet and 900 cubic feet per prisoner. Whether calculated on the superficial area or the cubic space of the ward, the smaller number obtained by such calculation shall be the maximum number of prisoners the ward can accommodate.

All cells for the separate or solitary confinement of prisoners shall have a superficial area of not less than 75 superficial feet and a cubic capacity of not less than 1,000 feet. There shall be through ventilation in every cell, which at the back may be by a clerestory window. The capacity of every ward must be shown on a wooden or metal tablet on the wall of each ward or barrack. Through ventilation of sleeping barracks is of the utmost importance. At least ten square feet of ventilation area must be provided for each prisoner. To calculate this, the area of each door or window is calculated by multiplying the length and breadth, and then by adding up the total for all openings and dividing this number by the number of prisoners the ward is ordered to contain.*

Prisoners are not allowed to open and shut the shutters at their own discretion. This is done in each ward by order of the Superintendent, who according to season gives directions for the closing or opening of shutters at night. In the rainy season the lower half of the wooden shutters may be shut, and on the approach of the cold weather this should be done, or in very cold weather all the shutters can be shut or each alternate one shut as ordered. This will depend much upon the situation of the jail and the climate, but the more control one can have over the ventilation the better. In hot weather all doors and window-shutters should remain wide open at night, and all the year round the shutters must be kept wide open during the day to insure a free perflation of air.† If from unavoidable causes it becomes necessary to keep a number of prisoners in excess of the sanctioned number, it is not wise to overcrowd the wards: it is better to use a temporary shed or the best workshed with a *pukka* floor where possible, and in such case each prisoner so accommodated must be provided with either an iron cot and mat or some form of raised bed; and if the workshed be an open one, it can be temporarily enclosed by bamboo mats and *jhamps*. In addition to doors and windows most wards have additional means of ventilation, either below the ceiling in double-storied buildings or along the eaves in gable-roofed buildings. In new barracks square openings 12″ × 10″ are provided at frequent intervals in the side wall below the ceilings; for gable-roofed buildings the best form of roof ventilation is by means of a ridge roof as shown in the following diagram:—

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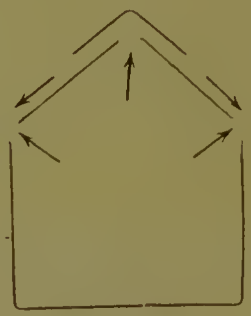
* An example will make this clear. Suppose a ward for 40 prisoners had 22 openings (2 doors and 20 windows); each opening is 7 feet × 4 feet, and there are also 40 ventilation holes under the ceiling one square foot each; then $7 \times 4 \times 22 = 616 + 40 = 656 \div 40 = 16$ square feet per man.

† Where doors and windows reaching to the floor are unprovided with batten or venetian shutters, it is necessary in the colder months to build up these openings for a height of 3 feet, so as to keep off the draught from the body of the sleeping prisoner. Such *kutcha* walls must be dismantled on the approach of the hot weather.



by these means the impure air which ascends is got rid of and fresh air enters from the lower openings. The ceiling and roof openings should be guarded by wire netting to prevent birds, etc., roosting there.

Above we have given the Jail Code Rules for ventilation, for the understanding of which the Medical Subordinate should know something of the scientific principles upon which they are based.

The Air.

The pure atmospheric air which surrounds us is known by chemists to have the following average composition:—

(O) Oxygen, 20·96 per cent.,
(N) Nitrogen, 79·0 per cent.,
(CO_2) Carbonic dioxide, ·04 per cent.,

with traces of other substances.

As regards these gases, as they are called, the composition of the air is practically everywhere the same. Air is purified (1) by the winds which dilute and sweep away impurities, bringing fresh air in their place; (2) by the rain, which washes the air; (3) by the power possessed by the green parts of plants of absorbing carbonic dioxide and setting free oxygen. Under the artificial conditions, however, of civilized life, where many buildings and many people are crowded together in towns and cities, the air often becomes stagnant and foul, and contains many suspended matters, as dust, sand, smoke, vegetable, and organic particles, *fungi*, moulds, and bacteria.

The atmosphere is vitiated in the following ways:—

(1) by the respiration of men and animals;
(2) by the combustion of coal, gas, oil, &c.;
(3) by the fermentation and putrefaction of animal and vegetable organic matters;
(4) by the refuse from various trades and manufactures.

Vitiation of Air by Respiration.

A human being at rest breathes at the rate of about seventeen times a minute. At each respiration about 30 cubic inches of air passes in and out of the lungs. The air taken into the lungs loses about 5 *per cent.* of its oxygen (which is absorbed by the blood in the small capillary blood-vessels of the lungs) and gains about 4 per cent. of carbonic dioxide from the venous blood. The expired air also contains a quantity of putrefiable organic matters. It is this organic matter which makes the air of close ill-ventilated rooms so prejudicial to health. It consists of vapour and suspended matters, such as particles of epithelium, and varies with the state of health of the inhabitants. These particles are rapidly absorbed by woollen materials. Impurity becomes distinctly noticeable by the sense of smell when the amount of carbonic dioxide exceeds ·06 per cent. The purity of the air in any dwelling depends upon the amount of cubic space for each individual, and upon the facilities afforded for the entrance of fresh and the exit of foul air. The long-continued breathing of even slightly vitiated air tends to cause anæmia, dyspepsia, general weakness, headache and fainting, and persons who have thus suffered are able to offer much less resistance to attacks of acute disease. Such persons soon become pale, partially lose their appetite, and after a time decline in muscular strength and spirits. Moreover, there is no doubt that an impure atmosphere causes a much more rapid spread of such specific diseases as typhus fever, plague, small-pox, scarlet fever, and measles, and among surgical cases, erysipelas and hospital gangrene. Of all diseases, however, tubercle of the lungs, or phthisis, is the most affected by impure air. The recognition of this fact that phthisis can be produced by impure air has caused many great improvements in the ventilation of hospitals and barracks, with the result that the former very high mortality from phthisis in armies and among prisoners has been greatly diminished. The occurrence of pneumonia and bronchitis is also favoured by impure air. In old days when hospital wards were imperfectly ventilated, an affection known as "hospital sore throat" used to be very common. So also erysipelas, hospital gangrene, and pyæmia have almost entirely been banished from modern hospitals by the use of free ventilation and the antiseptic treatment of wounds.

As regards the ventilation of Jail barracks, too exclusive attention often is paid to the amount of cubic space allowed per prisoner. The amount, 540 cubic feet, is by no means large, and it is usually calculated by counting the whole height from floor to ceiling, but it has been laid down by high authorities that anything over 12 feet height of ceiling is useless for ventilation purposes: therefore in calculating the cubic space of a room or ward, the height of the wall should be taken at 12 feet only, no matter if it is really higher than this. Again, these cubic spaces were settled on the supposition that the air was moving and would rapidly change itself. As a matter of fact, during many days and nights in India the air is not moving; and as the temperature of the air is often higher than that of the body, the foul expired air does not rise, it being of higher specific gravity than the atmosphere around. Another practical point is that the sleeping berths and the bodies of the prisoners take up a considerable amount of the cubic space supposed to be available. This, however, is usually forgotten in calculating the accommodation of a ward. Moreover, the high jail walls often to some extent prevent the free perflation of air. For all these reasons I have usually paid more attention to the amount of floor space provided per prisoner. The amount allowed, 36 square feet, is small enough: if it was 50, it would be better.

I am anxious to impress upon the Medical Subordinate the very great necessity for free ventilation, and to make him believe in the very certain evil effects of overcrowding.

Vitiation of the Air by Combustion.

This scarcely concerns Bengal jails, but in towns, and especially in cold climates and in manufacturing towns the use of coal fires is a powerful cause of atmospheric pollution. The use of oil, especially in badly-trimmed lamps, has also some effect in this direction.

Vitiation of the Air from Decomposition of Organic matters.

This is caused by the putrefaction of animal and vegetable matters in open cess-pools, in sewers, dirty drains, and heaps of rubbish. It is said that dysentery and diarrhœa can be caused by breathing air contaminated in this manner.

Vitiation of Air by Trades and Manufactures.

This concerns us little in regard to prisoners in jails. The great majority of trades or industries are injurious or otherwise according to the amount and nature of the fine dust which is produced in the process of manufacture. The long-continued inhalation of such dust tends to produce disease of the lungs, especially phthisis, bronchitis, and emphysema. This shows the importance of the proper ventilation of work-sheds and factories in which prisoners work. In the carding rooms of cotton and wool factories (as in the Buxar and Bhagalpur Central Jails) there is a great amount of dust and flue in the air, but owing to good ventilation no harm has resulted.

The fumes from burning brick kilns used to be productive of injury to health, but the modern kilns (Bulls' patent) now in general use in India, in which the fumes are carried away by a chimney shaft, are a very great improvement.*

To fœcal emanations and the air of sewers (especially of underground leaky sewers) is generally credited the production of diarrhœa, dysentery, and diphtheria. This, however, is doubtful as regards the first two diseases, but there is good evidence in favour of diphtheria being thus caused. As, however, fœcal matter, if not properly disposed of (*vide* below page 20), may find its way into the water-supply, and thus give rise to disease, it becomes very necessary to at once dispose of all night-soil in the manner hereafter to be described.

We have thus briefly explained the harm which bad air does, and the great importance of ventilation. The question of ventilation is easier in Bengal than it is in Europe, as all we have to do here is to open wide all doors and windows and in the hot weather keep them open night and day, which is not possible in cold climates like those of Northern Europe.

How then are we to estimate when the air of a room or barrack is prejudicial to health?

There are many ways of doing this, but they cannot be carried out in jails or without a proper laboratory: for practical purposes, however, the sense of smell is sufficient. The peculiar well-known fœtid odour of occupied rooms can easily be detected by any one on first entering the room from the open air outside. Therefore if this odour is perceptible, it is proof that ventilation is imperfect, and some doors and windows should be opened immediately. This can easily be tested by the Medical Subordinate going into any of the sleeping barracks a couple of hours after 'lock up.' If this peculiar and characteristic smell is perceived, ventilation is defective.*

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* Bulls' patent kilns are seldom used in District Jails, as they require paid labour to keep them agoing at night, but when bricks are to be made on a large scale they are best.

CHAPTER V.

CLOTHING.

THE main objects of clothing are to protect the body from cold, heat, wind, and rain; to maintain its warmth; to protect it from injury, and also to adorn it. The only materials of clothing with which we are here concerned are woollen and cotton.

Wool is a bad conductor of heat and a great absorber of water. During perspiration, after exertion or hard work of any sort, evaporation from the surface of the body is necessary to reduce the body heat. If, however, this evaporation is unchecked, the body may become chilled; so when dry woollen clothing is put on after exertion, the vapour from the surface of the body is condensed and the heat is retained. Therefore a woollen covering feels warm and comfortable, whereas in the case of cotton or linen clothing the perspiration passes through them and evaporation continues till a chill is produced. Woollen garments require very careful washing; they should never be rubbed or wrung out. They are best washed by being placed in hot water and moved about; then taken out and plunged into cold water, and hung up to dry without wringing. Soda and *sujjamuttie* are not good for woollen clothing. A simple plan for washing jail blankets and woollen *coortas* is to boil them in a boiler in the outer grounds, lift them out, and plunge them into cold water (as in a bathing-platform); then hang then at up once once to drip dry in the air and sun. Cotton clothing does not shrink in washing, is less absorbent of water, and conducts away heat more rapidly than wool. It is also very absorbent of odours.

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* For methods of calculating air space, etc., of various shaped buildings, see Appendix, page 132.

In jails it is one of the chief duties of the Medical Subordinate to see that every prisoner has a sufficiency of clothing and bedding in good repair. It is the Jailer's duty to see that indents upon the Manufacturing Jail are sent in good time and duly received, and that the prisoner's clothing is kept in good repair by the *dirzie* gang, and duly marked with the prisoner's number and other Government mark.

Prisoner's clothing.—The Jail Code (910) lays down as follows:—"All prisoners sentenced to rigorous imprisonment shall be furnished upon admission with the following:—

Males.	*Females.*
1 Cotton *coorta*.	1 Cotton *coorta*.
2 Do. *jangiahs*.	9 Yds. of cotton cloth, 38 in. wide.
1 Do. *gumcha*.	
1 Do. cap.	1 *Gumcha*.
1 Blanket coat.	1 Blanket coat.
1 *Tatputtee* for bedding.	1 *Tatputtee*.
2 Blankets.	2 Blankets."

In the jails of Chota Nagpur and Bihar a third blanket is ordered to be given to each prisoner during the cold season, and all members of the convalescent and special gangs or other old and infirm gangs are in addition given extra blankets, long or short woollen *jangiahs*, and a woollen cap. It is a very important part of the Medical Subordinate's duties to see to the proper clothing of these gangs (*vide* rule 918). Specially marked cotton clothing, blankets, sheets

(7′×4′), and *tatputtee* bedding are provided for use of the sick in hospital, and on admission to hospital the Medical Subordinate shall take from the prisoner his ordinary clothing and issue a complete set of hospital clothing washed and clean. The prisoner's ordinary clothing after being washed shall be stored in the hospital clothing godown for issue to the prisoner on his discharge from hospital (*vide* rule 916).

CHAPTER VI.

DISPOSAL OF SEWAGE AND REFUSE.

THE term 'sewage' is here used in its widest sense, and is meant to include the solid and liquid *excreta* of men and animals; the refuse from houses (dust, ashes, etc.), the liquid and solid refuse from stables, cowsheds and slaughter-houses, waste water used for manufacturing purposes, and the sweepings of paths and roads.

In jails we are chiefly concerned with the removal of the solid and liquid *excreta* of men and animals, dust, rubbish, food-refuse, and waste from various manufacturing processes. The arrangements made for this purpose are called the conservancy system. In large and crowded towns the removal of all these offensive matters is often difficult, but it is never so in an Indian jail. In every part of this country a class of men are obtainable who can do this work both willingly and well. Upon the efficiency of the conservancy system the health of the inmates of a jail largely depends, and the supervision of this work is an important part of the duty of the Medical Subordinate as well as of the Jailer.

The system in force in all Bengal jails is at once to remove the solid and liquid *excreta* to the soil; by so doing this material becomes harmless and also a valuable manure to the soil. We are not here concerned with the numerous methods by which this removal is carried out in other places than in jails.

Disposal of solid and liquid excreta.

The amount of bowel and kidney *excreta* passed daily varies in different persons and with different habits of life. On an average in Europe the daily solid *excreta* amounts to about 4 oz. weight and the daily liquid to about 50 oz. (1½ seers) per man, but this amount is far from correct for vegetable feeders, as the majority of Indian people are: for them the amount of solid *excreta* should be reckoned at *at least* 8 oz. (4 chs. per man) and for rice feeders probably more—say 30 seers per 100 prisoners, and about 4 maunds of liquid urine per 100 men. The rules in force for the disposal of this sewage are given in the Jail Code, rule 939, etc.—

"Drains and latrines must be kept scrupulously clean. Cess-pools of any kind or description are prohibited within jail precincts. No sewage matter of any kind shall be permitted to find its way into the drains of a jail, nor are rubbish or manure pits allowed within or near the jail walls. The planting of vegetables is prohibited within the walls, nor is any portion of the ground to be watered or manured for any purpose."

The practice of digging holes within the jail walls for shooting rubbish into should be discontinued. Any prisoners making urine in any drain or to save trouble pouring urine from any receptacle into a drain should at once be reported for punishment. Each enclosure or set of barracks shall, if possible, have a separate day latrine of the approved plan and an ablution platform, and there shall be a sufficient number of seats to allow the latrine parades to be completed within half-an-hour, allowing each prisoner 5 minutes or longer if need be, *e.g.*, an enclosure containing 200 prisoners should have a latrine with not less than 34 seats and 9 ablution platforms. Provision shall also be made for a sufficient supply of "dry earth" in every latrine. The best kinds of earth for this purpose are loamy surface soil, vegetable mould, dry clay or brick earth. Chalk, gravel, sand or dust are *not* suitable. Care must be taken that this earth is really "dry" and sifted. If it is necessary to dry this earth over a fire, care must be taken not to raise it to too great a heat so as to sterilise it; if sterilised, it is useless as a deodorant. Earth dried in the sun acts most efficiently. Care must be taken that before the parade each basket or other receptacle shall contain a deep layer of dry earth, and after use each prisoner must be directed to cover up his *excreta* with a good supply of dry earth from the box beside him. For the successful use of this method it is necessary to separate the urine from the solid matter. This is done by providing a second tarred basket for the urine of each prisoner. Where, as in jails, a plentiful supply of dry earth is available, this system is most satisfactory, and the contents of the night-soil baskets can be removed to the night-soil depôt without any offence. The receptacles in use vary in different jails, but no better or cheaper plan is in use than that of pitched bamboo baskets, which can be easily made in the jail. Each basket is well tarred before use, and is therefore water-proof. Before placing them in position in the latrines, the sweepers must rub the inside of each with dry ashes and put in a layer of dry earth about one inch deep. After use all receptacles, whether bamboo or iron, must be washed (outside jail walls) before being put back in their places. No earthen vessels are allowed to be used in or about the latrine.

ABLUTION PLATFORMS.

These should be made of the type plan. The recently introduced flat iron cylinders with a foot-rest on two sides are at once the cheapest, best and easiest cleaned. They should be in the proportion of one ablution tub to every four latrine seats. Water is provided in a reservoir close at hand, and each tub has a compartment screened off for itself in an iron shed which may be either part of the latrine or separate. The use of water for this purpose inside the latrines is absolutely prohibited.

REMOVAL OF EXCRETA.

Immediately after the latrine parade the sweeper gang must cover up all the solid *excreta* with a thick layer of dry earth and remove it to the night-soil depôt, where more dry earth is added and the mixture passed through the Donaldson's patent ejector (where such exists, or on truck and rails running through the wall as at Alipore and other large jails into the garden outside, whence it is at once removed to the trenching ground. If the ejector or other such system of removing the night-soil is not in existence, the night-soil baskets must be removed through the jail gate. When a proper amount of dry earth is used, no smell or offence will be caused.

It will be noticed that no mention has been made of the use of any chemical disinfectants or deodorants. If plenty of dry earth is used, they are quite unnecessary, and besides are harmful. The use of disinfectants, etc., in order to hide the smell is based upon a misconception: we do not wish to hide the smell; we wish to prevent it, and this can be done by the proper use of dry earth, but, moreover, the use of chemical agents are harmful, in that they inhibit, if not entirely destroy, the action of the nitrifying ferments in the earth and render it sterile. It is the presence of this nitrifying ferment in dry earth which brings about the disintegration and oxidation of organic matters, and so renders them harmless to man and useful to the soil. It is because sandy and chalky soils do not contain these ferments that these substances are useless for conservancy purposes.

THE TRENCHING GROUND.

Before taking up any ground for trenching, it should be properly drained, so that the surface layer of the soil shall be free from saturation by water. Each trench shall be laid out, with a rope, of any convenient length, and shall be one foot deep and one foot broad. The trenches shall be dug in parallel lines with space between each of not less than 18 inches. The night-soil, well mixed with dry earth, shall be placed in the trench to a depth of not more than 3 inches, and the trench then filled up with earth. Separate trenches must be provided for the urine and ablution water. They may be the same size as the other trenches or a little broader. Deep holes shall never be used for burying of either liquid or solid *excreta*. Refuse from the cook-house not fit for food for cattle must be disposed of in the same way as the night-soil, but road-sweepings and dry vegetable refuse may be collected in a manure pit as far away as possible from the jail walls till required for use as manure for the garden.

NIGHT LATRINES.

Each ward, cell, or cubicle in which prisoners are locked up must be provided with some form of night latrine, though the use of them by prisoners at night is not to be encouraged, and all prisoners who have used the latrine at night must be seen by the Medical Subordinate the next morning before work begins. The iron cage latrine which is practically outside the building is very useful. In each cell or cubicle a receptacle and a supply of dry earth must be provided, which must be removed at once when the cells are opened in the morning. Prisoners soon find that if they use plenty of dry earth, no unpleasant smell results from use of these receptacles even in a cell or cubicle.

HOSPITAL LATRINES.

Besides latrines in the wards of the same kind as the ordinary night latrines, bed-pans are provided for use of the more severe cases of illness, but for the majority of the sick in hospital, the ordinary enclosure latrine can be used, and the same rules are in force for its use. One or more sweeper must always be in attendance on duty, and at the morning latrine parade it is the duty of the head hospital sweeper to keep the stools of all cases of bowel-complaint for the inspection of the Medical Subordinate and the Medical Officer. The plan generally in practice is for each bowel-complaint case to have a separate receptacle in which his stool is kept covered up till inspection. Immediately after this has been seen by the Medical Officer, a large handful of quicklime is poured over the stool, and it is at once removed to the incinerator and burnt. This routine must be insisted upon by the Medical Subordinate. By this means all stools of cholera, dysentery, enteric fever cases are at once rendered harmless.

A good plan in force in most jails—that any prisoner who wishes to use the latrine "out of time," *i.e.*, at other than the regular parade times, shall be sent to the hospital. This rule is always a good one, but is specially necessary in times of prevalence of bowel complaints. A timely dose of medicine given at once will frequently prevent the necessity of the prisoner's reporting sick.

All road-sweepings, dead leaves, and such refuse are to be regularly collected and removed.

CHAPTER VII.

Water and Water-supplies.

Water being a prime necessity of life, it is necessary to provide it in ample quantity and in the purest state possible. All the natural sources of water are derived ultimately from the rain and snow which falls upon the earth's surface. The rain after falling upon the earth is disposed of as follows:—(*a*) part is evaporated by the heat of the sun; (*b*) part flows off in the direction of any inclination of the surface of the ground; (*c*) part percolates into the soil. It is the latter water which is the source of the underground springs, which form either natural openings on the surface of the earth or are artificially tapped by man by means of wells.

The sources of water-supply are very varied, but some of them do not concern us in considering the supplies to jails. They are as follows:—

(1) Rain water (including snow).
(2) Upland surface water.
(3) Spring and well water.
(4) River water.
(5) Distilled water.
(6) Sea water.

RAIN WATER.

This is the purest of all kinds of natural water. In its passage through the air it becomes highly aërated, but a the same time carries down with it any impurities which may be in the air, such as dust, smoke, etc. It is consequently cleaner in open country places than in large towns. It is collected in many ways—in India chiefly in the form of natural hollows or artificial tanks, or it may be collected from roofs of houses, etc., in cisterns. Rain water is very "soft,"* owing to comparative absence of salts of lime and magnesia; it is therefore good for washing and cooking purposes.

WELL AND SPRING WATER.

This water is naturally clear and bright in consequence of the filtration the water has undergone in its passage through the under-ground soil to reach the well.

Wells are usually divided into shallow (subsoil) and deep.† Shallow wells are those under 100 feet deep. Deep wells are those over 100 feet in depth. A variety of deep well is the Artesian, which may be sometimes even 1,800 feet deep. They are formed by boring through an impermeable stratum deep down in the earth to reach a source of water with another impermeable stratum below it. The water from Artesian wells is usually of great purity, and they have been found invaluable in some rainless countries.

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* For explanation see below, page 38.

† "Strictly speaking, there can be no such thing as a 'deep' well in the alluvial plains of Bengal"—(*Silk*).

Shallow wells usually vary from 10 to 50 feet in depth,* and are not good sources of drinking-water, as they are very liable to pollution at or near the surface of the ground, specially in loose soils and in the neighbourhood of towns.

Deep wells, if properly constructed and away from obvious sources of pollution, generally contain very good water.

Wells may be polluted in several ways—

(1) By dirt or organic matter being allowed to enter them from above, *e.g.*, by use of dirty vessels to draw water, a dirty rope, or by the falling into the well accidentally or otherwise of live or dead animals, etc., etc.

(2) By drainage from the surrounding area. It is known that a well drains an area of ground in the shape of an inverted cone, and the radius of the circular base of this cone is equal in length to at least four times the depth. An example will make this clearer. Suppose a well is 100 feet deep; the surface area drained by this well will be equal to a circle drawn round the well at a distance of 400 feet. Moreover, as the water in a well which is daily used does not remain at the same level, it has been found that a well will drain the surrounding soil for a distance, which varies from 15 to 150 times the depression caused by pumping or otherwise withdrawing water; thus if 10 feet deep of water is drawn out daily, the well will drain an

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* The deeper ones are also called "subsoil wells."

area all around to a distance of from 150 feet to 1,500 feet, *i.e.*, 500 yards. The importance of understanding this fact is that, if any source of pollution is within this distance from a well, the well water may become polluted. Hence the necessity of digging wells for drinking purpose at as far a distance as possible from cess-pools, grave-yards, or sewage drains. Surface pollution can be prevented by building the top of the well so as to project one or two feet above the level of the ground, and this surrounding wall should be made to slope outwards, so that any water spilled may flow away from, not inwards into, the well again.

There is another kind of well which is useful when a temporary supply of water is required; this is the tube-well, otherwise known as Norton's Abyssinian well. These are made by driving iron tubes into the soil, one length being screwed into another. The first tube has an iron point, and is perforated for a couple of feet above this. When the subsoil water is reached a pump is attached, and after pumping a short time the water which issues is clear.*

There is no need to detail the numerous familiar ways of drawing water from wells in India. Pumping is certainly the best method, but unfortunately pumps are very liable to get out of order in this country. Whatever vessel is used for drawing water it should be kept perfectly clean and used only for this purpose.

For jail use wells should always be *pukka*, *i.e.*, of masonry. The mouth must be protected and a trap-door provided; the masonry cylinder forming the well must be kept clean and water-tight, so as not to admit of percolation from the upper strata of the soil, and the well must be surrounded with a masonry platform and drain connected with the surface drainage system of the jail to carry off spill water and prevent it soaking into the ground around the well. It is also directed that the silt of every well the water of which is used for drinking, cooking, or bathing shall be carefully cleaned out every hot weather or oftener if the depth of water permit—(*Jail Code, rule 954*).*

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* Mr. A. E. Silk (*Municipal Engineering*, page 37) says that many tube-wells have been successfully used in districts and towns of Bengal.

RIVER WATER.

This is also an important source of water-supply. The water taken from large, deep, rapid-flowing rivers is generally better than from small streams. In the rainy season river water is generally very muddy, and needs settling and filtration before use. River water is very liable to pollution from villages and towns upon its banks, from dead bodies of men and animals being thrown into it, etc. It is now known, however, that the water of the great rivers of India is purer than might be expected; this is owing to the germ-destroying power of the intense sunlight, to the volume of water, and to the absence of factories, etc., on their banks, which in case of European rivers pour their refuse often direct into the stream.

Distilled water and sea water we are not here concerned with.

JAIL WATER-SUPPLIES.

In the jails of Bengal the following are the usual sources of water-supply:—

(1) From municipal water-works, brought to the jail in pipes. This water is usually derived from rivers, from which it is pumped by steam machinery into reservoirs; from these it is passed through large filter-beds and again collected in reservoirs to be distributed to the town and jail

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* Chains are better than ropes for drawing water and should be used.

in pipes. This is the best and most convenient supply of water. In this case water can be laid on all over the jail, and all manual contamination of the water is obviated.

(2) From wells. These are generally deep masonry wells; the water is good or bad according to the source of the spring and the presence or absence of cess-pools and other sources of pollution. Shallow *kutcha* wells are not satisfactory, and are not now used in jails. In jail gardens another cheap well is sometimes found, viz., ring tube-wells, on which rings of earthenware, made by potters, are substituted for masonry.

A weekly register of the height of the water in each well in use or of the depth of water should be kept. If one large good well of water with sufficient supply is available, it is best to use it alone for drinking purposes.

(3) River water. In some jails (where the well water is not good) water has to be drawn from a neighbouring river and conveyed in iron carts to the jail. Such water must always be filtered and boiled* before use, or if the jail is situated near a river, it may be pumped up by prisoners and conveyed inside the jail in pipes.

(4) Tank water. Tanks usually depend for their supply of water on the annual rains. In some cases large masonry tanks have been built, and are kept filled from a neighbouring well. Tanks outside jail are very liable to pollution, but inside a jail this can be prevented.

If, however, any other source of good drinking-water is available, tank water is best avoided. In gardens, however, they are of great use for irrigation purposes and for the keeping of fish.

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* Boiling in the Larymore boiler is easy, but so far I have seen no satisfactory method for rapidly cooling the boiled water. Unless this is done, prisoners will often prefer the cool bathing or other inferior water.

THE AMOUNT OF WATER REQUIRED.

It is always desirable to allow as liberal a supply of water as possible. Water is required in jails for many purposes—drinking, cooking, bathing, ablution, washing clothes and utensils, flushing drains, irrigation of crops in garden, watering roads, drinking and washing animals, etc. The amount required is usually reckoned as so many gallons per head, *i.e.*, the total daily supply divided by the population.

The following table from Parke's *Hygiene* is usually quoted, and may be here given, though some of the uses therein given do not apply to Bengal jails:—

		Gallons per head daily.
Household	Fluid as drink	·33
	Cooking	·75
	Personal ablution	5·00
	Utensil- and house-washing ...	3·00
	Washing of clothes	3·00
	Water-closets	5·00
	Trades and manufactures ...	5·00
Municipal	Cleaning streets	5·00
	Public baths, etc.	
	Flushing sewers	
	For extinguishing fires ...	
	Total ...	27·08 gallons.

that is to say, 27 gallons per head of the population for all purposes. It may be said that about 30 gallons per head of a mixed population, as in a town, is daily required. The Central Jail, Bhagalpur, which has a good water-supply from municipal water-works, receives about 35* gallons daily per head. The new water-works at Howrah gives 10 gallons per head of the population. This large amount of *filtered* water cannot, however, be supplied at present to all jails. It has been decided for the present to ensure a supply of 4 gallons of sterilized water to each prisoner daily in Bengal jails. This will be ample for cooking and drinking. For all jail purposes, including manufactures, it is probable that about 30 gallons daily per head is required. It is not necessary, however, that all this shall be filtered. Cattle in India require about 10 gallons of drinking-water daily, horses about the same amount, and about an equal quantity for washing.

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* On the average 10 to 15 gallons per head of water is necessary for all purposes, excluding manufactures.

THE PURIFICATION OF WATER.

It may become necessary to purify water to remove excessive hardness, suspended matters, dissolved organic matter, or the micro-organisms associated with various specific diseases.

This is usually effected in one of the following ways:—

1. *Distillation.*—By boiling the water in a suitable vessel and collecting the steam in cold pipes, where it becomes condensed again into water. This would appear to be the best means of obtaining pure water, but it has been found that unless the water is taken from a clean source, it may produce illness even if distilled. This has been shown in several cases where ships in harbour have distilled water from the dirty water of the harbour. This method has not, however, been used in jails.

2. *Boiling.*—This is perhaps the best, as it is the simplest, method in existence for sterilising water. Nearly all Bengal jails are now supplied with a special boiler in which this can be easily carried out. The water must, however, be really boiled, not merely heated. The boiler should be filled with water, then boiled, then the boiled water passed into the cooling reservoirs; cold water from the tap should not be

added while boiling, as is so frequently done. If water is laid on in pipes to the jail, a pipe should be attached to the boiler, and from the cooling reservoir the cool boiled water should be brought in pipes to the kitchen and close to the feeding-platforms, so that no other water be obtainable at these places.

Most germs are destroyed by boiling, and all by repeated boilings. "On the whole we may take it that water, even only once boiled, is in all likelihood safe, and if repeatedly boiled at intervals quite safe"—(*Notter and Frith's* "Hygiene," page 46).

Chemical Processes.

3. *Alum.*—This acts best in purifying hard water. About 6 grains* of alum per gallon of water should be added. The mud and other impurities sink to the bottom with the alum, and the clear fluid above can be decanted off for drinking.

4. *Clarke's Lime Process.*—Lime-water is thoroughly mixed with the water; the lime is then allowed to settle and the clear water drawn off, or the mixture may be strained clear through thin cotton cloth and then used.

The following method of using lime as a disinfectant of wells is recommended (*Inspector-General of Jails' Circular No. 49 of 1895*):—

The lime must be perfectly fresh; in fact when a certain quantity is added to the water, the heat developed ought to be sufficient to make the water boil. Lime should be added in the proportion of two parts in a thousand (2 in 1,000). The following formula worked out gives the amount of lime required for a well—"Multiply the diameter of the well in feet by itself and by the depth of the water; divide this by 10. The result gives the number of lbs. of lime to be added.

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* Some authorities say 20 grains per gallon, but from 3 to 6 grains will be found sufficient except for very muddy water, in which case a small quantity of lime added makes precipitation more rapid.

E.g., suppose a well 6 feet in diameter, and containing 40 feet deep of water; then 6 × 6× 40 = 1,440 ÷ 10 = 144; therefore in this case 144 lbs. of lime must be added. After adding the lime the water in the well must be well agitated for about an hour and-a-half by means of a bucket and rope, taking care to wash the sides of the well with the solution. Repeat this process after two days, and when the water has become clear, the well can be reopened for use.

5. *The Permanganate of Potash Process.*—To disinfect a well by this method a sufficiency of this salt is added to the well to give a faint pink colour to the water. The water must be well agitated, and then left undisturbed for one or two days, when the colour shall have disappeared and the water be fit for use.

For using this process for supplies of water other than well, take, say, 200 gallons of the water, add 200 grains of permanganate, stir it, keep on adding permanganate till a faint pink colour is persistent; then let the water stand for 18 to 24 hours, when it will be fit for use; if in addition 6 grains per gallon of alum is added, the water will become clear and good for use.

FILTRATION.

The object of filtering water is to remove all disease-producing germs as well as suspended matter. Filtration is of two kinds—(1) on a large scale as in a municipal or other water-works, and (2) domestic filtration.

On a large scale water pumped from a river or other source is received into "settling reservoirs," where the bulky substances subside; it is then passed into filter-beds, and is filtered through sand or gravel either by descent or ascent, or both, *e.g.*, one of the London Water Companies' filter-beds is made as follows—first a layer of sand 30 inches deep, next below 6 inches deep of gravel, next 6 inches of broken brick. The water passes through at the rate of 6 inches per hour, or 3·1 gallons per square foot of surface per hour.

The action of the sand filter-bed is partly mechanical and partly vital; the grosser suspended substances are kept back by the sand and gravel, but this is of secondary importance to the action which takes place in the slimy or gelatinous layer, which forms on the surface of the filter. It is this very fine slimy layer which arrests the passage of the extremely minute germs of disease. This gelatinous or slimy layer soon forms, and should not be disturbed till it becomes so thick as to be practically impermeable to water. Then and then only it should be cleaned. Constant meddling with this surface layer in the name of cleaning is one cause of imperfect filtration. It must also be remembered that filtration is a slow process. If a heavy weight of water is poured upon a filter-bed, it forces its way through, but the water is not filtered. If filtration is thoroughly done, the number of microbes which pass through should not be more than 100 in a cubic centimetre of water; the more efficient the filtration, the fewer microbes will pass through.

It is not here necessary to explain how these microbes are counted. The process is simple, however, and requires but little apparatus. Mr. Hankin of the Agra Government Laboratory has published a small pamphlet, giving instructions as to how this microbe-counting is carried out. This test of filtration is very useful, and indeed is the only means we have of knowing whether a filter is acting properly or not. If this test shows a small number of microbes, so much the better, for the larger the number of microbes which pass through the filter, the greater is the danger of some of them being the germs of specific disease, as of cholera or enteric fever. Therefore this test is useful, not as a substitute for chemical analysis, but as a test for the efficacy of filtration.

DOMESTIC FILTRATION.

This subject may be dismissed in a few words for two reasons—*first*, that it does not concern jails; *secondly*, that almost all domestic filtration is a delusion: in fact, with the ordinary cheap house filters in use more harm than good is done. Such filters are usually made too small: it is only on a large scale that filtration is really effective. The slimy layer on the surface is the real filtering medium. This does not form on small, constantly changed, filters. In jails filtration is done on a somewhat larger scale, but not on so large a scale as in municipal water-works: however, the method is the same and the remarks above apply. The jail filter should be of sufficient size to slowly filter sufficient water for drinking and cooking purposes. At present efforts are being made to supply sterilised water at the rate of 4 gallons daily *per* prisoner. This will be sufficient for drinking and cooking. The usual jail filters are composed of sand, *jhama*, gravel, and broken brick, and should be of such size as will filter 400 gallons per 100 men daily. Care should be taken not to too frequently disturb the above-described layer of slime upon the surface. If the filter acts slowly, more time must be given.

Even after passing through the filter all water for drinking purposes should be boiled and passed into the cooling reservoirs.

Above we stated that all domestic filters are useless. An exception must, however, be made in favour of one kind of filter, viz., the earthenware filters on the Chamberland-Pasteur, and those on the Berkefeld principles.

The Pasteur filter consists of a cylinder or series of cylinders of unglazed kaolin (a kind of earth) with a certain degree of porosity and hardness. The Berkefeld filter is on the same principle; the cylinder being, however, made of what is known as infusorial earth. Both give a filtrate practically free from germs. These filters are made in all sizes and shapes, and can be set up to filter water for a small household or for a whole city. A trial of them is being made in several Bengal jails, *e.g.*, Motihari, Dumka, Dinajpur, and Bogra Jails.

Examination of Water.

It does not come within the scope of this book to describe the methods of chemical analysis, nor would a description be understood by the Medical Subordinate without a knowledge of chemistry. Rule 958 lays down the orders for the chemical examination of the water-supplies of jails, and the Medical Subordinate should remember in what month the water from his jail is to be sent to the Chemical Examiner, Calcutta.

We have, however, referred more than once to "hard" and "soft" water, so that an explanation is necessary.

The "hardness" of a water depends upon the presence in it of the salts of calcium (lime) and magnesium and some free carbonic acid. Many of these salts are held in solution by the carbonic acid. Hardness may be either "permanent" or "temporary." After boiling the hardness which remains is called "permanent;" the amount removed by boiling is "temporary." Rain water is usually very soft, as also river water, but water from deep wells, especially in Punjab, is often very hard. Hard waters are not good for cooking, especially for cooking *dál.**

Diseases produced by Impure Water.

Unless the water provided for drinking actually contains the specific germs of disease, it is not to be expected that the effects of an impure supply should be sudden and violent. The results are rather gradual and insidious.

The following diseases have very frequently been traced to the use of impure water, viz., dyspepsia, diarrhœa, dysentery, malarial fevers, parasitic (worm) diseases, goitre, and especially cholera and enteric fever.

(1) *Dyspepsia.*

Symptoms which may be referred to under the convenient name of dyspepsia, such as loss of appetite, vague uneasiness or pain in the epigastrium, and constipation. The injurious salts in these cases are chlorides, sulphates, and nitrates of calcium and magnesium.

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* *Vide* Administration Report, Bengal Jails, for 1896.

(2) *Diarrhœa.*

This very common complaint of the inhabitants of Bengal has often been shown to be due to the use of impure water. Suspended mineral waters, suspended fœcal matter, or vegetable *debris* in water will give rise to either a chronic form of diarrhœa or to violent gastro-intestinal attacks. Brackish water, *i.e.*, water from marshes near the sea coast, often has given rise to outbreaks of diarrhœa. Sewage finding its way into drinking-water has also frequently caused outbreaks of this complaint.

(3) *Dysentery.*

"This disease is decidedly produced by impure water, and the substitution of a pure for an impure supply has been frequently followed by a decrease in the prevalence of dysentery in an affected community."—(*Notter and Frith*, "Hygiene," page 38).

It is not to be understood that impure water is the sole cause of this disease, as seen in Bengal jails, but it being one important cause, the greatest care is now being taken to provide a pure supply of water for drinking and cooking. It is impossible here to record the numerous instances in which outbreaks of dysentery have been directly traced to the use of impure water. Two will suffice. In a town on the west coast of Africa an outbreak of dysentery was traced to the passage of sewage from a cess-pool into a drinking-water tank. This was remedied, and an almost total disappearance of the disease took place.

Again, in 1870 at the town of Metz in France, a severe outbreak of dysentery occurred in two regiments, the rest of the troops there escaping. Inquiry showed that the two affected regiments drank water from a well which was grossly contaminated with fœcal matter from latrines placed close to it. These wells were closed, and the disease immediately disappeared. Eleven years after the same wells were re-opened, dysentery again appeared, and the closing of these wells again had the effect of stopping the disease.

In most cases water which gives rise to dysentery is polluted with fœcal matter, and probably with dysenteric stools.

(*d*) *Malarial Fevers.**

In those countries in which malarial fevers abound it is difficult to separate the effects of impure water from other causes believed to be provocative of these diseases. Cases have, however, occurred on boardship and other places where other causes could be excluded in which it has been possible to trace sudden outbreaks of ague to the drinking of water known to have been drawn from malarious sources. Water from marshes or *nalas* full of decaying vegetation is generally believed to cause fever. A few historical instances must here suffice. A party of men building a bridge in the *Terai* and drinking the water from the stream suffered much from fever. A well was dug and this water used for drinking, and the people using it find the place as healthy as any other. Other cases might be quoted from India and America showing the prevalence of ague among those drinking water from rivers draining large forest areas.

On the other hand, many authorities doubt the connection between impure water and attacks of malarial fever. One writer states that "proof that malarial fever can be conveyed by water is wanting, though very largely credited by the natives of countries where the disease prevails." The cases of the Royal Navy and Bengal jails may be cited in this connection. As regards the Navy, though within recent years very great improvements have been made in the water-supply of ships, yet there has not been any corresponding falling off in the number of cases of ague admitted to naval hospitals, and in case of Bengal jails it cannot be shown so far that there has been any such lessening of the number of ague cases among the prisoners to correspond to the very great improvements which have been made with regard to the supply of pure drinking-water.

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* *Vide* remarks below (page 101) on the subject of the spread of malarial fevers. In view of the mosquito theory it is possible to say that the water was only concerned in providing a place for the breeding of the mosquito larvæ.

(5) *Goitre.*

The opinion that goitre is due to the use of certain waters and to the presence in them of lime and magnesium salts is a very old and prevalent one, but recent researches have not supported this view. In some hill stations, where goitre is very common, the drinking-water has been found "exceptionally pure" and without any evidence of the presence of magnesia and only traces of lime. In other cases the use of water containing lime and magnesia has not caused goitre. Therefore the case of water as a cause of goitre is non-proven.

(6) *Parasitic diseases.*

The following parasities or worms are believed to find entrance into the human body by means of drinking-water :—

(*a*) *Bothriocephalus latus*, or tape-worm.
(*b*) *Distoma hepaticum*, or fluke-worm.
(*c*) *Ascaris lumbricoides*, or round-worm, which is very common in many districts of Bengal, *e.g.*, Saran, and also in Assam, Burma, and Madras.
(*d*) *Anchylostoma duodenale.*—This worm (*vide* below, page 117), which is very common in many districts in Bengal and North-Western Provinces, and which is known to be the cause of much disease in Assam and Ceylon, is also believed to be propagated by the ova or eggs finding their way into drinking-water.

(*e*) *Filaria dracunculus*, or Guinea-worm, is probably introduced by use of impure water containing its ova. It is very common in the Punjab and Afghanistan and rare in Bengal. It gives rise to severe abscesses in any part of the body in its endeavour to penetrate the skin.

(7) *Cholera.*

The evidence is every year growing stronger that cholera is a water-borne disease. It is *not* to be understood that water is the sole means of introducing this poison, but it is the most common cause and one to which on an outbreak of cholera attention must first be directed (*vide* below, page 86). When it is stated that cholera is introduced by impure water, it is not meant that any impure water will give rise to this disease, but only that the water which produced the outbreak had been polluted by the passing into it of the *excreta* of a patient suffering from that disease. Impure water which does not contain the cholera poison may produce bowel-complaints, but will not produce cholera. When cholera evacuations obtain access to drinking-water, it renders the water immediately capable of producing the disease. If this water is drunk, the cholera micro-organism may in many cases be destroyed by the acid secretions of the healthy stomach during the process of food digestion, but in cases where the digestion is out of order and the cholera germ finds its way into the intestines cholera invariably follows.

Thousands of examples might be quoted of cholera being introduced into a community by means of water, but only a few can here be given—(1) The celebrated case of the Broad Street pump. This occurred in London in 1854. Cholera *excreta* from a neigbouring house found its way into this well, and the people who suffered from cholera were found to have used the water of this well. Other people in the same street using another water-supply escaped.

(2) A recent case in 1892 in Germany. Two towns (which were so close together as practically to form one large city), called Hamburg and Altona, had a different water-supply. Altona obtained *filtered* water from the river Elbe, and Hamburg got its water-supply direct from the same river unfiltered. Altona with its filtered water practically escaped from cholera, while Hamburg with its unfiltered river water suffered very severely.

(3) The following case occurred in the central jail at Yerroda near Poona (Bombay):—Out of 1,279 prisoners there were 24 cases of cholera in 5 days with 8 deaths. Of the 24 cases, 22 occurred among a gang of 134 prisoners employed as a road gang. Some of the road gang drank water from the Mootla river, little below a spot where the clothes of two cholera patients had been washed and their bodies burnt a few days before. The rest of the convicts (1,145 in number), who remained inside the jail, were not attacked except in the two following cases. All these 1,143 prisoners who escaped the disease only were able to drink the usual jail-supply from a lake near Poona. The two men attacked, who did not belong to the extramural gang, were both sick attendants on the cholera cases in hospital, and one of them was proved to have taken his food, against orders, in the cholera ward.

Numerous other cases could be quoted, but enough has been written to show that cholera is in very many instances, perhaps in the great majority of instances, introduced by means of drinking-water,* though, as will be seen below, it can be introduced by other agencies, as by flies, food, etc.

(8) *Enteric Fever.*

The evidence in favour of this disease being usually conveyed by means of water is very strong. It is, however (as in the case of cholera), generally believed that only water which has been polluted by the fœcal discharges from a previous case of enteric fever that can reproduce the disease. Whether sewage *per se*, that is, without the specific germ derived from a previous case, can produce the disease is still disputed. This disease is not often found in Bengal jails, but it is very common and fatal among young Europeans in India.*

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* For other means of introducing cholera (*vide* below, page 86).

CHAPTER VIII.

Food.

The Principles of Dietetics.

For an understanding of the principles upon which diet scales are framed it is necessary to state briefly the facts which physiologists have discovered by means of chemical analysis and actual experiment. It will be seen that the practice of nations has in this instance foreshadowed scientific facts, and it is of advantage to be able to bring to the support of conclusions based upon long-established custom and habit precise experimental proof.

By an elaborate series of experiments the two celebrated German physiologists—Pettenkofer and Voit, were able to determine with exactness the daily total income and output of the body.

For the settling of the amount of food to be daily supplied to soldiers in regiments, prisoners in jails, or to inhabitants of public institutions like hospitals and asylums, it is necessary to construct diet tables which are not only scientifically correct, but are based upon the observed customs of the class of people for whom the food is intended. Before, however, doing so it is necessary to explain what food is.

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* Cases, however, have been recently reported in several jails in India. All cases of continued or "remittent" fever should be especially observed and the possibility of enteric (typhoid) fever borne in mind.

Food has been defined to include everything taken into the body which goes directly or indirectly to the growth or repair of the body or to the production of energy in any form. Consequently a perfect food is one which contains all the elements which enter into the composition of the tissues, juices, and secretions of the body, and those which are necessary for the functional activity of the organs, these elements being present in a mode or combination which enables them to be digested and assimilated. Milk, for example, is a complete and typical food: it contains all the necessary elements, and for infants at least in their best form.

The four "alimentary principles" are as follows:—

(1) Albuminates (proteids or nitrogenous matter).
(2) Fats or hydrocarbons.
(3) Carbo-hydrates or starchy food.
(4) Minerals or salts.

There is really a fifth class, which, though they have but little direct nutritive value are of great importance, in that they stimulate appetite and in various ways aid the processes of digestion. These are stimulants and condiments. They are also called "food accessories."

ALBUMINATES (or proteids) are so called because they are allied in chemical constitution to albumen or white of egg. They are never absent from any vegetable or animal food. As all structures of the body contain the chemical substance called nitrogen, this element is required for the formation of new and the repair of old tissues.

Examples—Fibrin, legumin (from peas, *dâl*, etc.), casein (from milk), gluten (from cereals).

FATS OR HYDROCARBONS.—These are composed of carbon, hydrogen, and oxygen. Their chief duty is to repair the fatty tissues of the body. Fats are less used in the food of the inhabitants of tropical countries, whereas the dwellers in arctic regions largely subsist upon pure fat.

CARBO-HYDRATES.—These are also made up of various proportions of carbon, hydrogen, and oxygen. They are also called "starchy foods." The starch in them is converted by the processes of digestion into grape sugar, which is stored up in the liver. It is believed that they are ultimately converted into fat, but though fats and carbo-hydrates have much in common, yet they are not so completely convertible as to allow us to substitute one for the other (Parkes).

MINERALS AND WATER.—These are of great importance; all tissues contain lime. Common salt is essential to life.* Certain salts, as lactates and malates, are so important that when absent that form of malnutrition called scurvy inevitably follows. These exist abundantly in fresh vegetables, hence the value of the latter in the cure and prevention of scurvy.

Man being an omnivorous animal obtains his food-supply from both the animal and vegetable kingdoms. A distinction is often made between foods from the vegetable and from the animal kingdoms, and it is true that some races partake more of animal food and some more of vegetable, but, as the tables below (I and II) show, both classes of food contain the same alimentary principles, and on analysis yield the same chemical substances, though in various proportions. In cold northern climates the inhabitants live largely upon animal food, as mutton, beef, eggs, milk, etc., while inhabitants of warm countries, such as India, partake chiefly of foods derived from the vegetable kingdom, as rice, wheat, *dâl*, etc.

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* It is not easy to understand why such different quantities of salt should be given in the Jail diet scales of the different provinces of India. Bengal and Assam give 330 grains, daily, Bombay and Madras 1 oz. daily, the Central Provinces 218 grains, and the North-West Provinces only 160 grains. The German Chemist, Bungo, says 30 grains daily is sufficient.

The following table, which gives the analysis of the chief foods used in India, will explain more clearly what is meant by the above remarks. It gives the relative quantities of nitrogen, carbon, and the percentage of fats contained in one ounce of each substance :—

TABLE I.

NAME OF FOOD.	Nitrogen in grains.	Carbon in grains.	Percentage of fats per oz.
Wheat	9·22	170·	·020
Barley	5·81	170·	·024
Rice	5·07	170·	·003
Maize	6·93	170·	·080
Pulses (*dâl*)	17·63	170·	·017
Uncooked meat	10·65	64·	·034
Fish	11·5	52·4	·030
Fats and oils	...	345·6	1·000
Milk	2·75	30·8	·039
Bread	5·5	199·0	·016
Potatoes	1·0	49·0	·002
Vegetables	·7	33·5	·003
Onions	1·0	13·5	·003
Eggs	8·0	64·0	·015
Sugar	...	187·0	...
Molasses (*gur*)	...	149·5	...
Sub-acid fruits, *e.g.*, tamarind	5·7	17·5	...

A glance at this table will show that while rice, wheat, barley, and the pulses contain about equal quantity of carbon, yet the amount of nitrogen varies very considerably. Therefore equal quantities of these foods are not of equal nutritive value. Rice, for example, contains less nitrogen than wheat and an equal quantity of carbon. Therefore one seer of rice is of less nutritive value than the same quantity of wheat or maize. Meat, again, contains more nitrogen than wheat, maize, or rice, but a much smaller quantity of carbon, while pulse (*dâl*) contains a very high proportion of nitrogen, hence its great value as a food. Fish differs but little from meat in both respects, and milk contains but a small proportion of both nitrogen and carbon, but a good proportion of fat.

The following table gives the percentage composition of the foods usually used in Bengal jails:—

TABLE II.

Percentage Composition of Foods.

ARTICLE OF FOOD.	Water.	Albuminates.	Fats.	Carbo-hydrates.	Salts.
Rice	8·2	7·3	·8	83·2	·5
Wheat flour	14·5	13·0	1·5	70·3	·7
Maize „	14·3	10·0	6·7	66·5	2·5
Pulses (*dâls*)	12·5	24·8	1·8	58·4	2·5
Meat	75·	15·0	8·4	...	1·6
Fish (white)	78·	18·1	2·9	...	1·0
Milk	86·8	4·0	3·7	4·8	·7
Vegetables, average	85·4	14·7	·55	12·4	·1
Millet	12·3	11·3	3·6	67·3	2·3

With these tables before us it becomes a question of arithmetic only to determine the nutritive value of any diet scale which it is wished to examine.

The experiments of many physiologists have resulted in the laying down of what are called standard diet tables, in which are given the amount of each alimentary principle which should be found in a complete diet.

The following table gives the standard diet of Moleschott:—

TABLE III.

	Oz.
Albuminates	4·59
Fats	2·96
Carbo-hydrates	14·26
Salts	1·06
Total water-free food in oz.	22·87

This gives about 23 oz. of water-free food daily, and is calculated to be sufficient to maintain in good bodily health and vigour a man of 150 lbs. weight doing an ordinary day's work. This is a standard diet for Europeans, however, or for men of 150 lbs. average weight, but individual conditions of size, vigour, activity, sex, etc., must be considered.

It has been found, as the result of the weighing of 28,000 prisoners in certain Bengal jails, that the average weight of the individual Bengal or Bihar prisoner is about 110 lbs.* or less, as 105 lbs. has been stated to be an average weight for Bengalis of the prisoner class. Therefore a standard diet, which is suitable for men of 150 lbs. would be excessive for men of 110 lbs.

It will be found that the following tables, which give the nutritive value of the diet scales in use in Bengal jails, are therefore ample and sufficient for Bengal prisoners of an average weight of 110 lbs. or less.†

TABLE IV.

Bengal Scale (Ordinary).

	Albuminates, oz.	Fats, oz.	Carbo-hydrates, oz.	Salts, oz.	Nitrogen in grs.	Carbon in grs.
DIET NO. I. Rice, *dâl*, etc. (Rice as morning meal.)	3·55	·866	26·52	1·11	250	6·777
DIET NO. II. Rice, *dâl*, etc. (Gram for morning meal.)	4·01	·888	24·90	1·17	284	6·781

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* 109 lbs. has been found by me to be the average weight of Bengal jail prisoners as the result of over 28,000 weighments, chiefly from Bihar jails—*vide* Appendix, page 135.

† For a detailed examination of the nutritive value of the Bengal Jail diets, see an article by the writer in the *Indian Medical Gazette*, May 1896, and Jail Administration Report for 1895.

Bihar Diets (Ordinary).

	Albuminates, oz.	Fats.	Carbo-hydrates.	Salts.	Nitrogen in grs.	Carbon in grs.
Diet No. 1—Wheat, rice, etc. (Rice for M. meal)	4·12	·93	25·1	1·13	292	5,957
Diet No. 2—Wheat, rice, etc. (Gram for M. meal)	4·58	·96	23·5	1·18	327	5,781
Diet No. 3—Wheat 3 ch., maize 2½ ch., rice, etc. (Rice for M. meal) ...	4·07	1·27	25·6	1·25	288	6,130
Diet No. 4—Wheat, maize, rice, etc. (Gram for M. meal)	4·53	1·29	24·0	1·32	322	5,954
Diet No. 5—Rice, maize (only). (Rice for M. meal)	4·03	1·60	26·1	1·37	282	6,306
Diet No. 6—Rice, maize (only). (Gram for M. meal)	4·49	1·63	24·5	1·30	318	6,130

From this it will be seen that though both are sufficient, indeed ample, yet the wheat diet of up-country people (Bihar scale) contains more nutritive matter than that of the Bengal, scale. This is in accordance with the dietetic habits of these peoples.

The Jail Code allows a very wide discretion to the Medical Officer in the matter of diet—in fact, he may vary to a very large extent the above diets. If he considers it necessary, he can substitute quantities of meat, fish, milk or *dahi* for the whole or part of the *dâl* in either of the above scales; he may also give milk or meat as an extra, or may increase the amount of condiments, salt or oil per man issued. The following tables show that the substitution of milk, meat or fish in lieu of *dâl* is not so much for the purpose of increasing the quantity of food, which is sufficient, as by giving variety to tempt the appetite, and so insure consumption of the food. This can also be done by giving different kinds of *dâl* from day to day, by varying the vegetables, by giving a different morning meal. If *goor* be given with the morning meal, the salt ($\frac{1}{16}$) should not be deducted, but given as extra in the two other meals ($\frac{5}{16} + \frac{1}{16} = \frac{6}{16}$):—

TABLE V.

Permissive Diets (Bengal Scale).

	Albuminates, oz.	Fats, oz.	Carbo-hydrates, oz.	Salts, oz.	Nitrogen in grs.	Carbon in grs.
Permissive diet No. 1—Rice, *dâl*, etc. Rice for morning meal. (Meat 2 ch. for 1 ch. *dâl*)	3·65	1·17	26·32	1·13	258	5,673
Permissive diet No. 2—Rice, *dâl*, etc. Rice for morning meal. (Fish 2 ch. for 1 ch. *dâl*)	3·38	·947	25·32	1·10	261	5,625
Permissive diet No. 3—Rice, *dâl*, etc. Rice for morning meal. (Milk 4 ch. for 1 ch. *dâl*)	2·96	1·13	25·71	1·06	236	5,663
Permissive diet No. 4—Rice, *dâl*, etc. Gram for morning meal. (Meat 2 ch. for *dâl* 1 ch.)	3·71	1·19	23·70	1·18	290	5,677
Permissive diet No. 5—Rice, *dâl*, etc. Gram for morning meal. (Fish 2 ch. for *dâl* 1 ch.)	3·84	·969	23·70	1·16	295	5,629
Permissive diet No. 6—Rice, *dâl*, etc. Gram for morning meal. (Milk 4 ch. far *dâl* 1 ch.)	3·42	1·15	24·09	1·12	270	5,667

Permissive Diets (Bihar Scale)

	Albuminates, oz.	Fats, oz.	Carbo-hydrates, oz.	Salts, oz.	Nitrogen in grs.	Carbon in grs.
Permissive diet No. 1—Rice, wheat, etc. Rice for morning meal. (Meat 2 ch. for *dâl* 1 ch.)	4·22	1·24	23·99	1·25	299	5,853
Permissive diet No. 2—Rice, wheat, etc. Rice for morning meal. (Fish 2 ch. for *dâl* 1 ch.)	4·35	1·18	23·99	1·12	303	5,806
Permissive diet No. 3—Rice, wheat, etc. Rice for morning meal. (Milk 4 ch. for *dâl* 1 ch.)	3·93	1·20	24·38	1·08	279	5,466
Permissive diet No. 4—Rice, wheat, etc. Gram for morning meal. (Meat 2 ch. for *dâl* 1 ch.)	4·68	1·23	22·37	1·20	333	5,677
Permissive diet No. 5—Rice, wheat, etc. Gram for morning meal. (Fish 2 ch. for *dâl* 1 ch.)	4·81	1·04	22·37	1·14	337	5,629
Permissive diet No. 6—Rice, wheat, etc. Gram for morning meal. (Milk 4 ch. for *dâl* 1 ch.)	4·39	1·22	22·76	1·14	313	5,667

In these tables the correct nutritive equivalents of *dâl* and of animal food are used in accordance with the following table :—

TABLE VI.

	Nitrogen.	Carbon.	Fats.
Dâl, 1 ch. (2·05 oz.) ...	36	348	·034
Meat, 2 ch. (4·10 oz.) ...	42	262	·147
Fish, 2ch. (4·10 oz.) ...	47	214	·123
Milk and *dahi*, 4 ch. (8·20 oz.)	22	252	·295

If less than 2 ch. of meat or fish is used in lieu of 1 ch. of *dâl*, the food given will be of less nutritive value, though it is possible that owing to the variety it may be better digested. However, the Jail Code (Rule 880) orders that nutritive equivalents as above shall be issued.

As regards preparation of food, the Medical Subordinate should carefully study Jail Code Rules 881 to 889, and see for himself daily that these orders are carried out.

VEGETABLES.

The Medical Subordinate must also assure himself that good wholesome vegetables only are used for the prisoners' food; see appendix to Jail Code, page *lx*, for a list of vegetables to be sown month by month.

For practical purposes vegetables may be broadly divided into two classes—

(1) those which are good antiscorbutics;
(2) those which are not.

It is very important for the Medical Subordinate to know to which class a vegetable belongs. The following list mentions the most common vegetables of each class :—

I.—Vegetables of high antiscorbutic value.

Potato.
Onion.
Radish (country and English).
Cress.
Brinjal.
Yams and sweet potato.
Otaheiti potato.
Okra (ram turaee).
Lettuce.
Artichoke.
Carrots.
Seakale.
Swiss chard.
Turnips.
Tomato.
Celery.
Parsley.
Mint.
Cabbages of all sorts, including Roman and China.
Tapioca.
Parsnips.
Beetroot.
Mangel-wurzel.
Asparagus.
Kurram cabbage.

II.—Vegetables of less antiscorbutic value.

Vegetable marrow.
Gourds (*kurela*).
Pumpkins.
Cucumber.
Spinach and *ságs* of all kinds.
Melons.
Kuddu (red).

Potatoes and onions are especially valuable, and should be stored carefully at the end of the cold weather for use during the rains. This is, I think, best done as follow :—

On a large shelf or *muchan* a layer of fine dry river sand two inches deep is spread and on this sand are spread out the potatoes and onions. They should not touch each other. If stored in heaps, these vegetables grow and sprout or become rotten and unfit for use.

The juice of the potato is somewhat acid, and contains vegetable acids combined with soda, potash, and lime, which give it its valuable antiscorbutic properties. It also contains a large proportion of easily digestible starch. The sweet potato (*Batatos edulis*) and the yam (*Dioscorea batatas*) are also useful substitutes for the potato. The former is rich in starch, and contains much sugar.

Tapioca, the root of the *Manihat utilissima*, also grows well in jail gardens. It contains an easily digested starch. Carrots, parsnips, and turnips are all useful fresh vegetables. All contain starch and sugar. The beetroot and mangel-wurzel are both excellent antiscorbutics, and should be largely cultivated. The pleasant pungent taste of the radish, both country and English, makes it an agreeable addition to any mixture of vegetables. It is highly antiscorbutic, and should be freely cultivated to be ready in September, or even August.

Cabbages are among the most valuable of all forms of green food. They are very wholesome; but contain sulphur, which sometimes gives rise to flatulence if too exclusively partaken of.* Cauliflower is one of the commonest and most delicate of the tribe. Roman cabbage is useful, because it can be got to grow in the hot season, as also can China cabbage, a most valuable addition to our list of hot-weather vegetables. Tomatoes are also very high-class vegetables: they can be kept well into the hot weather.

In the list of less valuable vegetables above have been included watery vegetables, like gourds, cucumber, pumpkins, etc. They contain a very large quantity of water and a less amount of acids and salts. Consequently, though useful and pleasant additions to food, they are of no value as antiscorbutics. The same remark applies to *ságs*. *Ságs* are so easily grown that they very frequently make their appearance in the prisoners' diet.† The Medical Subordinate must guard against a too frequent use of *ságs* of all kinds, for not only are they useless as antiscorbutics, but owing to their laxative qualities they will help to increase any tendency there may be to diarrhœa among the prisoners. It is also necessary to avoid the use of old, decaying, or of tough fibrous parts of vegetables. Tough fibrous vegetables are not digested, and only act as intestinal irritants, and cause diarrhœa, etc.*

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* A too free use of country radishes without admixture of other vegetables has similar results.

† As regards *ságs*, Captain Jennings, I.M.S., Superintendent of Bareilly Jail, maintains that *ságs* contain a large amount of antiscorbutic salts, but easily part with the salts in boiling. He recommends that the water in which the *ságs* have been boiled should not be thrown away, but used to cook the *dâl* in: in this way the salts are not lost.—*See* letters in *Indian Medical Gazette*, June, and July 1900.

ANTISCORBUTICS.†

In addition to the vegetables given above, there are certain fruits which are specially used in Indian jails as direct antiscorbutics, viz., mangoes, limes or lemons, papayas, plantains, tamarind, and roselle. These fruits contain large quantities of vegetable acids and salts of lime, magnesia, and iron. These vegetable salts are called malates, citrates, and tartrates; they become converted in the system into salts of soda and potash; hence their great value as antiscorbutics. The agreeable flavour is due to the presence of essential oils, etc. The Jail Code directs that "one or other of the following antiscorbutics shall be issued daily with the midday and evening meals to all native prisoners in the quantity per prisoner mentioned opposite each kind" (Rule 879):—

Lime juice	$\frac{1}{2}$	chitak.
Amchur	$\frac{1}{12}$	,,
Tamarind pulp (free from husk, fibre, and seed)	$\frac{1}{8}$	,,
Putua or roselle	$\frac{1}{12}$	,,

It must be clearly understood that this ration of antiscorbutic fruit is in addition to the ordinary condiments and tamarind in the daily scale.

The method of preparing *chutneys* or pickles from these fruits is clearly detailed in Jail Code Rule 882 and appendix, page *lxiv*, etc.

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* In the cold weather when vegetables are abundant, vegetables should be dried and stored for use in the hot weather and rains. [*See Inspector-General, Jails' (Bengal) Circular No. 3 of 1900.*]

† The necessity for antiscorbutics will be explained below in the remarks on Scurvy, page 114.

These must be prepared in due quantity at the proper season.

In damp districts or in the case of prisoners from Eastern Bengal confined in Bihar jails, it is often found useful to issue a larger quantity of chillies than the proportion laid down in the list of condiments in Jail Code Rule 879. It is found that these chillies aid in the digestion of the bulky meal of rice.

In addition to the lime orchard (which should contain one *kaghazi* lime-tree per prisoner), a good supply of all antiscorbutic fruits should be provided in all jail gardens by planting tamarind, *bael*, *amrah*, mango, and *papita* trees in available places. One tamarind-tree per 50 prisoners and one *bael*-tree per 30 prisoners at least should be grown. As is well known, the *papita* fruit is an excellent digestive. *Bael* is also a valuable fruit, and can be made much use of in the jail hospital.

Lime juice should also be made and kept in stock. When issued it should be mixed with sufficient sugar or *goor* to counteract the bitter taste.

In cases of acute diarrhœa from eating croton-oil or castor-oil seeds it is said that 4 or 5 ounces of lime juice in water is an excellent antidote. It being always at hand, it should certainly be tried.

PREPARATION OF FOOD (JAIL CODE RULE 881, ETC.).

Of equal importance is the quality, proper preparation, and cooking of the food and its issue in full quantity.

All items of the dietary shall be weighed out to the cooks in a fully-prepared state, or if this is impossible, with a full allowance for any loss which must occur in the preparation by the cooks. The following instructions must be strictly observed:—

(1) No rice less than three months old shall be issued.

(2) If rice is produced from paddy in the jail, the paddy shall not be husked until it is a month old, and the rice from

it shall not be issued until it is thoroughly dry or within two months from the time the paddy is boiled and dried.

(3) The rice when weighed out to the cooks must be free from husks, dust, or any foreign matter, and from broken rice.

(4) Of broken rice separated from the whole rice, the half-grains may be used without admixture of whole rice for the early morning meal.

(5) The smaller particles of broken rice and other refuse shall on no account be issued for prisoners' food.

(6) The weight and bulk of cooked rice from a given weight of uncooked grain will vary according to the age of the grain and the season. The weight of 6 chitaks of raw rice when cooked varies from 16 to 18 chitaks. The proper weight of the cooked ration should therefore be frequently tested by experiment.

(7) Wheat and maize shall be thoroughly freed from dirt, unsound grain, and other subtances before they are ground into flour. As maize becomes weevil-eaten and deteriorates in nutritive value by April, wheat shall from the 1st of that month be used till the new crop of maize comes in. The flour shall be sifted through a fine perforated zinc sifter (No. 6 gauge) or fine wire gauze.

(8) No *dâl* shall be cooked until it has been thoroughly husked, and until unhusked grains have been carefully picked out. *Kalai* and *mung** cannot be thoroughly husked before they pass into the cook's hands, as they have to be soaked and rubbed to get the husk off. When these are issued an excess of *10 per cent.* beyond the scale allowance shall be given to compensate for subsequent loss of weight in husking. The use of *khesari dâl* is prohibited, and *dâls* of different kinds or *dâl* and other grains must not be cooked together. The use of *kalai dâl* should be limited to the

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* *Kalai* and *mung* can only be thoroughly husked by soaking in water and repeated washings. This must be carefully done before they are put into the pot for cooking. The *mar*, or water strained from the rice, need not, be thrown away. It can be used with advantage to boil the *dâl* in.

hotter months of the year, when it is appreciated for its cooling effects. The consistency and bulk of the cooked ration should be frequently tested. Some *dâls* become hard by storage; such should be well soaked in water and be cooked very slowly.

(9) Antiscorbutics must be used in full weight of the edible parts, full allowance being made for husk, seeds, and fibre.

(10) Only succulent vegetables shall be used. They shall be freed from stalks, fibrous portions, rotten leaves, etc. Potatoes and onions when issued may be spiced with oil and chillies and given as *bhurtha.* They must be examined daily by the Medical Subordinate.

Fish when issued shall be weighed exclusive of fins, scales, heads, and tails. When meat is issued an allowance of 20 per cent. extra shall be given for bone.

The Medical Subordinate should also see that the full measured quantity of food is issued to each prisoner, and should listen to any complaints about the food, and enquire into the matter at once. He should also see that the kitchen is kept clean and neat, and all cooking utensils scrupulously clean and bright. It is also important to see that prisoners have a shady place to eat their food in. This is best done by allowing a verandah for this purpose at time of midday meal when there is no shade from walls, etc. In the early morning and in the evening the food can be issued at the regular feeding platforms. In rainy weather shelter must always be provided.

EXAMINATION OF MEAT.

The meat given in jails is that of the sheep or the goat. There should always bo a proportion of fat. The bone is usually calculated at 20 per cent. of the whole, and this allowance must always be given. The muscles should be firm, and yet elastic, it should possess a pleasant, sweet flavour. There should be no lividity on cutting across the flesh with a knife. If the odour is disagreeable or the colour at all greenish, it should be rejected. The flesh of an old goat is dark and strong. It is a good plan which is in force in some jails for the butchers to bring the live sheep or goats to the jail and slaughter them under supervision in some part of the jail compound.

DISEASES ARISING FROM UNWHOLESOME MEAT.

(1) Worms or parasitic disease, such as tape-worm, trichinosis, etc.

(2) Symptoms of poisoning, gastro-intestinal disorders (vomiting, diarrhœa, etc.) may arise from partly decomposed meat, especially if kept too long before cooking in hot weather. It is also certain that tuberculosis can be transmitted to the human subject from eating the flesh of tuberculous cattle. The flesh of all sheep or goats suffering from disease of all kinds should be rejected.

EXAMINATION OF FISH.

It is very necessary to allow only fresh fish to be used as food. A fresh fish is firm and stiff: if held by the shoulder, the tail should not bend or droop downwards. Spots of softness should be looked for, and if found, the fish is to be rejected. The flesh of all fish very rapidly decomposes. One worm disease (the tape-worm known as *Bothriocephalus latus*) can be communicated to man by means of the flesh of fish. Poisoning from decomposed fish gives rise to gastro-intestinal symptoms similar to those produced by bad meat.

CHAPTER IX.

THE JAIL DAIRY.

THE care of the milk-supply of the jail should be in the hands of the Medical Subordinate. He shall (Jail Code Rule 110) daily inspect the sheds in which milch cows are kept, and shall see that these places are kept clean and free from smell, and that the vessels for boiling and holding milk are clean and fit for use. He shall keep a daily record of the quantity of milk obtained from the jail cows and its expenditure. The milk or its produce shall firstly be devoted to the needs of the sick in hospital (especially those suffering from bowel-diseases or dropsy) and of prisoners in the convalescent. and special gangs. After the wants of these and any old and weakly prisoners are satisfied, the balance over may be used for ordinary prisoners (usually 4 chitaks of milk or *dahi* are given in turn to ordinary prisoners in lieu of 1 chitak *dâl*). The milk drawn from the cows must be at once measured and at once boiled, and allowed to cool before issue. It should be kept in as cool and well ventilated a place as possible.

MILK.

The milk of cows is the only kind which we are concerned with in jails. Milk is, as we have seen above (page 45), for infants a perfect and complete food, as it contains (for them) in the proper proportions all the four great alimentary principles. The percentage composition of cow's milk is usually stated as follows:—

Specific gravity	1032.
Total solids	12·83
Albuminates	3·55
Fats	3·69
Carbo-hydrates	4·88
Salts	0·71
Water	87·17

Human milk contains more carbo-hydrates and less albuminates, and about the same amount of fat. The milk of goats and buffaloes is richer in albuminates and fats, but both contain less carbo-hydrates. The composition of cow's milk, however, is not uniform, but varies on account of different food, peculiarities of breed, the time since calving, etc. A cow which gives ten seers of milk daily is a very good cow for India. The average amount given, even by well-fed jail cows, is about 5 or 6 seers per head. After a cow is eight years of age the milk usually deteriorates in quality, though not always in quantity. The milk of the first few days after calving is very rich, and should not be used for children or for the sick.

EXAMINATION OF MILK.

Fresh milk when placed in a glass should be of full white colour, without deposit and without any peculiar taste and smell. When allowed to stand cream should arise, and the quantity of cream if measured in a graduated glass should be from 6 to 11 per cent. Milk is very frequently adulterated, either by the removal of the cream or by the addition of water, or other substances along with water, as starch, flour, chalk, etc.

TESTS FOR MILK.

The only practicable test for the Hospital Assistant is the specific gravity test, and this is not without its fallacies. At the temperature of 60°F. the specific gravity of milk is from 1027 to 1034. The specific gravity falls at the rate of one degree for every 10°F. of temperature above 60°. So at 80° it would be about 1025, at 90°F. about 1024. For every ten parts of water added there is calculated to be a loss of 3° of specific gravity, but this rule only holds good for a temperature of 60°, a temperature only found in India in winter mornings. The effect of the specific gravity test can be neutralised by adding chalk or flour to the milk; but if the usual specific gravity of the milk and the usual amount of cream is known, a lower specific gravity and a less amount of cream points to watering. If the cream alone is removed, the specific gravity becomes higher in proportion to the amount of the (lighter) cream removed.

THE PREPARATIONS OF MILK.

These are butter, *ghee*, cheese, and tyre (*dahi*). We are not concerned with any of these except *dahi*. If *ghee* is needed for cooking European prisoners' food, it is better purchased. It is not necessary to here describe the familiar process of making *dahi*,* as it is well known to the Medical Subordinate. It cannot be too strongly impressed upon the Medical Subordinate that it is his duty, and his alone, to see that the milk obtained from the cows is made over to him in full quantity; that the amount is measured at once, and entered in his milk account; that the amount remaining *after* boiling is noted; that a daily account is kept of the prisoners receiving milk or *dahi*, with the amount given to each; that all prisoners receiving milk shall have the amount, and for how long, entered on their history tickets, with the date; that such accounts are daily balanced; that no head-warder or other subordinate is allowed to present milk accounts to be entered in the office registers; that the Medical Subordinate's account alone is to be taken; that the accounts shall show plainly what amount of milk was used as milk and what amount set apart for *dahi*, and from what day's supply of milk the *dahi* was made, and finally what amount of *dahi* was obtained.

THE COW-HOUSE.

The building devoted to this purpose should be roomy and well ventilated. At least sixty square feet of floor space should be provided for each animal, *i.e.*, a space 8 feet × 8 feet. The floor must be of some material which will not absorb urine, water, etc. It may be of brick-on-edge, well cement-pointed; rough concrete is also good, and the floor should have a fall towards the drain, just sufficient to carry away all urine and washings to a channel running the full length of the shed. This masonry drain should empty by a spout into iron receptacles, removable by hand, and not into the ordinary surface drain of the jail. Cows actually in milk should be stall-fed and kept inside the jail; sucking calves must remain with their mothers, but all weaned calves should be kept separate.

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* *Dahi* with *mar.* is an excellent diet for acute dysentery cases.

The manurial value of the urine and sweepings of the cow-shed should be remembered, and use made of them in the outside garden.

All cows should be kept clean, in fact "groomed" daily by their attendants, as syces do horses. In every case the udders should be washed as well as the hands of the milkman before milking. The milkman must be directed to report all cases of eruptive disease of the udder at once, and it is a safe rule to condemn the milk of such cows as unfit for human use. More attention might also be paid to the water-supply for cows. These animals will drink any water, however filthy. The water is best supplied in troughs and brought in pipes.

Food of Milk Cows.

Where possible it should be arranged that cows giving milk should be kept inside the jail walls; dry cows, old calves, and bullocks may be kept outside.

In addition to as much grass as it wants, each cow should receive the following amounts of food daily:—

Bhoosee (from *dâl*)	2 seers.
Bran (from *àtta* of wheat)	½ seer.
Bhoosa (after threshing wheat, *gram*, *urhur*, etc.)	6 seers.

In some jails oilcake (½ seer per cow) daily is given. It is said by some jailers to improve the quantity of milk.

Congee water (from rice) is also useful, and always available. Small quantities of dust rice unfit for prisoners' food may also be given. Hay should be stored for use in the dry season. When there is grass it should be given in abundance daily.

DISEASES PRODUCED BY IMPURE MILK.

It is not yet decided whether cows are susceptible to human specific diseases, as diphtheria, enteric fever, scarlatina, etc., but there can be no doubt that milk may be a vehicle for transmitting these diseases.

There are various ways in which disease germs gain admission into milk, viz.—

(1) From the cow itself, *e.g.*, anthrax, tuberculosis, foot-and-mouth disease, and acute enteritis.

(2) From the hands of the milker, *e.g.*, typhoid fever, cholera, diphtheria, and scarlet fever.

(3) From impure water, which may be used for washing the vessels, for cooling the milk, or for adulteration, *e.g.*, typhoid, cholera, diarrhœa, etc., or indeed any disease communicable by water. Milk may also absorb septic matters from foul effluvia in its vicinity, as manure heaps, latrines, etc. Milk, especially when warm from the cow, should never be exposed to any sort of smell.

The milk of cows suffering from foot-and-mouth disease or from inflammation of the udder soon turns sour and ropy, or it may have an unpleasant smell and contain blood, pus, etc. Foot-and-mouth disease is communicable to persons drinking the milk in the form of eczema of the mouth and face, and when there is any disease or eruption on the udder the milk should be deemed unfit for human food. It has been now placed beyond a doubt that tuberculosis can be transmitted from affected cows to man by means of the milk.

CHAPTER X.

SOME COMMON DISEASES OF CATTLE.

WE cannot here enter into this subject in detail; but as the Medical Subordinate is often consulted in cases of cattle-disease in the jail dairy, it is necessary for him to know something about the subject.

The following are the chief cattle-diseases found in India:—

(1) RINDERPEST.

Rinderpest (called vaguely in Bengali *basunto;* in Hindi *gotee* or *mata.* These words are also used for human small-pox, an entirely different disease).

Rinderpest is a severe and fatal form of contagious fever. It is characterised by dulness, shivering, constipation, rise of temperature, twitching of muscles, furring of the tongue, profuse discharge of viscid mucus from eyes, nose, and mouth. Purging soon sets in. Prostration becomes great. Sometimes an eruption is seen about the dewlap, groins, and udder, and is often a favourable symptom.

The disease is spread by means of the mucus discharged from the mouth and nose; hence grass becomes affected. It is necessary, therefore, to rigorously isolate all affected cattle; and if the disease prevails among cattle outside the jail, cattle should be kept within the walls.

The treatment is chiefly symptomatic, and is only successful in mild forms of the disease.

Give Epsom salts (4 chitaks) or common salt (8 chitaks) in warm water, repeated every hour, till the bowels are freely moved, or the following mixture (I. Tweedy):—

R.—

Camphor	...	...	8/4 tolah.
Nitre	...	...	¾ ,,
Datura seeds	...	...	¼ kancha.
Chiretta	...	...	¾ tolah.

Mix and give at once.

The food must consist of wheat or barley gruel, well cooled, with some salt added. The mouth of the animal must be well washed frequently, and secretion wiped away. The milk must not be used, even by the calf, and all litter and dung of the affected animals should be burned.

(2) FOOT-AND-MOUTH DISEASE.

Foot-and-mouth disease (called in the vernacular *khoori* or *khoorpocha*). This is a very contagious fever, accompanied by a vesicular eruption in the mouth and in the feet and udder. The same animal may suffer several times from this disease. The symptoms are hot mouth, fever, salivation, eruptions in mouth, and on feet and udder. The eruption appears in the form of blisters, which burst in the course of a day, and leave red raw sores. Purging is generally absent.

The milk of affected cattle can spread the disease, and the infection can also be carried by the hands of the milker to healthy people.

If the sick animal is attended to, the disease usually disappears in three or four days, and the animal recovers.

Treatment consists in washing out the mouth three or four times daily with warm water or warm alum lotion (1 chitak to 1 pint of water); also wash the udder with the same lotion, and after washing the feet dress the sores with the following lotion:—

Mustard oil	...	... ½ seer.
Turpentine	...	... 2 chitaks.
Camphor	...	... 2 ,,
Phenyle	...	... ½ chitak.

Diet—Gruel, treacle, soft green grass, or *doob* grass only.

Isolation of the sick animals is very necessary.

(3) ANTHRAX.

Anthrax is a very fatal and malignant disease, and is communicable both to other animals and to man. The attack is usually sudden, the animal becomes dull, a swelling is usually found under the skin of the throat or in the loins or hind-quarters or on the tongue. This swelling is said to crackle under the fingers. The appetite is dull, breathing is rapid, and the breath very hot. The animal becomes unconscious, and dies of exhaustion within 24 hours.

Treatment is usually of little avail. Epsom salts may be tried. Only rice or barley gruel must be given as food.

The dead bodies must be deeply buried in lime, or better burned. The secretions from a case of anthrax are very infectious, and by the grass of fields being thus infected, the disease is often spread. The blood contains the germs of the disease in large quantities, and consequently the dead animal should be buried or burnt without cutting the skin in any way.

Anthrax is known as a human disease under the name of wool-sorter's disease, charbon, or malignant pustule. It is usually found among those who trade in or prepare wool and skins.*

(4) COW-POX.

(4) Cow-pox is a contagious disease, but seldom fatal. It only attacks a cow once in a life-time.†

The symptoms are eruptions about the centre and base of the teats and on the udder in the form of circular pustules about the size of a four-anna bit. These pustules become filled with a clear fluid, which gradually becomes opaque and purulent, and are surrounded by areolas of inflammation. In a few days the scabs fall off, and dry up gradually.

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* It may be noted that a case of wool-sorter's disease has *never* been known among the prisoners employed in the large woollen factory in the Central Jail, Bhagalpur. The disease, however, is common in Madras.

† This disease is believed to be identical with small-pox in man. It was owing to the immunity observed in milkers during a small-pox epidemic which led Edward Jenner to introduce vaccination in 1796 as a protection against human small-pox.

Treatment consists in isolation; then draw off the milk, which is not to be used; rub the udder over with *ghee* or carbolic ointment; keep the animal clean and feed on light food.

(5) PLEURO-PNEUMONIA.

As the name implies, pleuro-pneumonia is an inflammation of the lungs and pleura. It is, however, probable that it is a contagious fever.

The disease begins by a shivering fit, a peculiar masked cough, loss of appetite, and in cows giving milk by a drying up or lessening of the amount of milk given. In a few days fever sets in, with hot mouth, increased cough, and very rapid breathing; later on there may be purging. If both lungs are attacked, the animal seldom recovers.

The treatment is mainly dietetic. No known drug will stop the course of the fever. Soft green food, gruels, and plenty of good water must be given.

Isolation of affected cattle is imperative.

CHAPTER XI.

THE JAIL HOSPITAL.

A JAIL hospital should provide accommodation for about 8 per cent. of the total capacity of the jail. There should also always be a special ward or wards for the treatment and isolation of cases of infectious disease. This should always, if possible, be in a separate building, and as far away as possible from any other inhabited building. In addition in every jail there is a separate hut or huts in the jail garden for the treatment of cholera, plague, small-pox, or other epidemic diseases.

The hospital may either be in one or two separate buildings, and may be of one or two stories, according to the size of the jail and the nature of the climate. In every case a hospital should be provided with deep shady verandahs, preferably on both sides. The front of the hospital should face the east, so that it should be in the shade during the whole afternoon. There should always be a separate room or rooms for the office and dispensary. In the latter, all drugs, medical and surgical appliances should be kept in locked almirahs. The poisons must all be kept in a separate almirah, and the key of this must always be in possession of either the Medical Subordinate or the compounder. In large jails there is also usually a separate room for use of the Medical Subordinate on night duty. The hospital wards should be especially well ventilated. The windows should all be provided with wooden shutters, divided in such a way that the lower or upper halves may be open or shut as required, so as to give the fullest possible control over ventilation. The floor and cubic air-space should be provided much more liberally than in wards for healthy prisoners. The Jail Code lays down as a minimum 54 square feet and 900 cubic feet per prisoner. One window for every two beds should also be provided. For cases of infectious disease the above figures should at least be doubled.

CARE OF SURGICAL EQUIPMENT.

All steel instruments, *e.g.*, knives, forceps, scissors, etc., must be kept bright and clean. After use, all steel instruments must be washed, carefully dried, and lightly smeared over with vaselin (to keep them from becoming rusted) before being put away. Any instrument containing India-rubber needs special care, and syringes, if not in constant use (*e.g.*, hypodermic syringes and aspirateurs), must be frequently taken out and water run through them.

Catheters also need care. Silver ones must be kept dry and polished with the stylets in place. Gum elastic catheters are usually kept dry in a flat box with lycopodium powder or fine arrowroot. Before use they must be cleaned in carbolic lotion and sterilised by boiling water. The tip or portion beyond the eyehole specially needs cleaning.

Antiseptic dressings, which are often expensive, should be kept in special tin boxes and scrupulously clean. They must never be allowed to lie about on shelves or in drawers.

Stock mixtures.—It is found convenient to keep certain stock mixture of drugs in common use. They should be kept neatly arranged in a row, with a label showing the prescription and date of preparation, and average dose. The formulæ recently issued by the Inspector-General of Civil Hospitals for use in Bengal dispensaries are admirable, and adapted to jail use. The compounding of drugs is the duty of the Medical Subordinate alone, except in large jails, where there is also a compounder. No prisoner, however skilled, must ever be permitted to compound drugs. Spatulæ, slabs, pill-making machines, scales, and weights must always be kept clean and in good order.

For every bed in hospital there should be a wooden or tin ticket-holder and temperature chart-holder. These should ordinarily hang on the wall at head of patient's bed.

Hospital Tickets.

All the printed headings must be duly filled up. It is specially important to note the form of labour and the sleeping ward from which the patient came to hospital.

The diet should be shown and all changes noted; the quantity and frequency of issue of each extra ordered to be entered.

First should be noted date of prisoner's coming to hospital, and for what complaint. Then should follow a brief note of previous important illnesses of patient in jail or outside. Then must be briefly described the patient's present condition as to presence or absence of fever, condition of the bowels, pulse, pain, etc., according to the disease or symptoms compained of; there should be a brief statement of the state of the lungs, spleen, liver, etc. Signs of anæmia, œdema, dropsy, etc., are to be noted if present; also any eruption or skin disease, and patient's weight before admission to hospital.

In recording above the Medical Subordinate must carefully distinguish between what he knows or observes for himself and the mere statements of the prisoner. Thus it is not enough to record "had five stools last night," rather should it be recorded "*Says he* had five stools," etc., etc. In this way from day to day brief notes may be made of patient's condition. No elaborate description is necessary. The shorter the note is the better, provided that it clearly expresses the facts. In bowel-complaint cases the condition of the stools must be described, such as watery, thin, semi-solid, or normal, or accompanied with blood or mucus. If blood is in the stools, the presence or absence of piles should be inquired into. The stools of bad diarrhœa and dysentery cases, and new cases of these diseases should be kept for inspection of the Medical Officer. The sweeper in charge should have at hand a basket of quicklime, and as soon as the stool has been inspected, he must pour over it a couple of handfuls of lime, and remove all to the incinerator. At the head of each bed should be a spittoon; it should have a layer of mixed lime and fine earth in it, and should be cleaned daily or oftener as required.

HOSPITAL BEDS AND BEDDING.

Jail hospitals are usually supplied with iron cots. To make them comfortable for the sick, each cot should have a piece of bamboo matting and over this a straw rope mattress. The ordinary bag mattress is often soiled with discharges, and is not easily cleaned. They are therefore objectionable, but the straw rope mattress is comfortable, cheap, easily made, and can easily be burned if fouled in any way. They add much to the patient's comfort. Over them can be spread the prisoner's *tatputtee*, and one or two spare blankets. Pillows are not allowed. A folded blanket answers the purpose. Each cot has also two hospital sheets, which must be changed as often as required. Two or more blankets, according to season, should be given to each patient on admission to hospital, as well as a suit of special hospital clothing in exchange for his own, which must be sent to be washed and kept ready for the prisoner on his discharge from hospital. The godown for hospital clothing is in sole charge of the Medical Subordinate, who is also responsible for its being kept in good repair and in sufficient quantity.

All hospital clothing after use must be removed to the outside garden and boiled, washed, and dried before being returned to the godown.*

Hospital Conservancy.

During the day an outside latrine of the ordinary pattern is provided for use of those of the sick who may be able to use it. For those who are too weak to go so far, inside latrines are provided and bedpans where necessary. An ample supply of dry earth or other disinfectant should always be at hand in each ward, and it must be the duty of the ward-sweeper to see that the stools are at once and properly disinfected.

All clothes, bedding, etc., which has been fouled by patient's discharges must be at once removed, disinfected, washed, and boiled or, if necessary, burnt.

Hospital Servants.

The jail hospital should have a convict-dresser and medicine distributor, and in large jails a convict-writer. There must also be a waterman, and a head-sweeper and sweepers. For the hospital kitchen where it is separate, as it should be, from the general kitchen, there must be a cook and one or two attendants. One convict-warder or overseer should be in charge of all hospital convict-servants as his gang.

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* The clothing and bedding of dysentery or acute diarrhœa cases must be always boiled in a disinfectant solution before washing. This should be a daily routine of the hospital.

Many of the sick in hospital will not need a "sick attendant," but all serious cases of illness should have one or more convicts of the same caste as special attendants according to their needs, especially for frequent feeding. It is found that prisoners make kind nurses, and they should be instructed what to do, and to report at once to the Medical Subordinate on duty anything new in the progress of the case. Convicts who do good work as nurses should be brought to the notice of the Superintendent for a reward of special marks.

Hospital Routine.

Every morning before the Medical Officer's visit the wards must be regularly cleaned and swept. All doors and windows should be opened according to season. As far as possible, the ordinary jail routine for latrine and bathing parades should be preserved. The Medical Officer will decide what sick men are to be allowed to bathe in the usual way. Those who cannot bathe must be washed with warm water, and their bodies kept clean. They should also be rubbed with oil daily. If personal cleanliness is neglected, the clothes become infected with vermin—a positive proof of neglect of Jail Code orders.

Hospital Food and Cooking.

The instructions already given for ordinary cooking apply with even more force to the cooking and preparation of food for invalids. The more a Medical Subordinate knows about cooking and the more attention he pays to it, the more success he will have in the treatment of the sick. Food which is good for a healthy prisoner will not always agree with the sick. It is impossible to lay down scales of diet for the sick which would be useful, as this is done by the Medical Officer of the jail. However, diets for hospital are usually divided into low (or sago) diet, half diet, full diet. It is not desirable to adhere closely to any particular diet scale: each case must be dieted according to its needs. It is especially necessary not to insist rigidly on the sick taking their food at the same time as the healthy. What is wholesome discipline for the healthy may not suit the sick. But in addition to the regular morning, midday, and evening meals, there should always be ready food which may be administered at any time according to a patient's needs. I have found it best to keep warm soup ready at all hours of the day, so that a prisoner can get some when he needs it. It can be made from the *bones* which so often are thrown away and wasted. The Medical Subordinate should see to this.

CHAPTER XII.

Under Observation Cases.

In all jail hospitals it is the custom to keep under observation, for a period not exceeding 24 hours, all cases presenting themselves for treatment. This is, however, a custom which very readily lends itself to abuse. The portion of the 24 hours between the patient's coming to hospital and the Medical Officer's next visit will usually be found sufficient. It is not necessary to have made a correct diagnosis before formally admitting a patient, and it is certainly prejudicial to the sick man to be kept a couple or more days under observation before final admission. Let the sick man be duly admitted, and treat his urgent symptoms. There is no necessity on the first day to scribble a diagnosis or rather name of a disease on the hospital ticket. Many cases of "fever" turn out to be bronchitis, tubercle, pneumonia, etc., as well as ague.

THE MORNING ROUND.

The Jail Code (Rule 92) lays down that, at the opening of the jail, the Medical Subordinate shall at once see any prisoner complaining of sickness. He should either treat the patient at once if the complaint is trivial or send him off to hospital. The Medical Subordinate should also visit the cells. This round is in no sense intended to be a substitute for hospital, and prisoners really needing hospital treatment should be sent there at once. The practice is, however, useful, as it acquaints the Medical Subordinate with the diseases prevalent in the jail, and a timely dose of medicine given in this way may prevent an illness.

The Medical Subordinate should be accompanied by a convict-dresser, carrying a box, containing the following articles:—

(1) A tonic mixture.
(2) An astringent mixture.
(3) An "iron and arsenic" mixture or a "spleen" mixture.
(4) Castor-oil, or other purgative, or other such combinations of drugs as the Medical Officer may direct.
(5) A supply of bandages and antiseptic ointment (for minor injuries and sores).

The practice, however, of treating prisoners as "out-patients" is one to be discouraged.

THE PROPHYLACTIC ISSUE OF QUININE OR OTHER PREPARATION OF CINCHONA.*

The system of giving every prisoner in jail a prophylactic dose of quinine or cinchonidine has only been introduced into Bengal jails since 1895. Whether the general good health and low rates of mortality in 1895 and 1896 is to be attributed in part to this practice is not yet certain, but personally I am strongly inclined to credit the issue of the quinine with the improved health of the prisoners in those two years.

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* In Bengal the prophylactic is generally issued only from end of June to end of October, the rainy season, but this is left to the discretion of the Medical Officer.

As quinine is a known remedy for malarial fevers, and as it also has a tonic effect in small doses, it is reasonable to suppose that its regular issue will do good; and I believe it is safe to say that the majority of those who have practised medicine in tropical countries are in favour of the prophylactic issue of quinine. If there is one fact in tropical pathology that is certain it is that a strong malarial element underlies all forms of cachectic disease in this country. Few doubt the strong malarial taint in cases of chronic dysentery, anæmia or scurvy, and it is reasonable to believe that if quinine is given regularly, there should be a lessening of fevers generally, and also of dysentery and diarrhœa. This, indeed, has been found to be the case in some jails. I would impress upon the Medical Subordinate the advantage of being enthusiastically in favour of this system: he will find by so doing the plan will work well.

The prophylactic doses of cinchonidine* is left to the discretion of the Medical Officer, but not less than 5 or 6 grains should be given. I have found the combination of cinchonidine (grs. 5) and sulphate of iron (grs. 2) to be very useful. The quinine may be exhibited either dissolved in dilute sulphuric acid or mixed with lime juice, and the solution must be kept ready in sufficient quantity. It can be distributed by selected convict-overseers, one or more for each enclosure. It is perhaps best administered just before the early morning meal. The distribution of the drug must be supervised by the Jailer and Medical Subordinate and other responsible officials (Head Warder, etc.) present at the time. It is useful to reward at the end of the season those prisoners who have given aid in the quinine distribution.

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* As the difference in price now between quinine and cinchonidine is not great, and as quinine sulphate can be used in smaller doses, it is perhaps better to make use of quinine.

All prisoners must take the drug: it may be unpleasant, but it will do no harm to any of them. Prisoners refusing to take the medicine should be reported at once to the Superintendent. Complaints will sometimes be heard of symptoms of quininism, but this can be easily remedied by allowing the prisoner to get off taking the drug for a couple of days.*

THE CONVALESCENT AND SPECIAL GANGS.

(*Jail Code, Chapter 39.*)

In all jails there will be found gangs of this description. It is laid down in Chapter 39 of the Jail Code that, when necessary, two gangs shall be formed as follows:—

(1) The convalescent and infirm gang.
(2) The special or losing-weight ,,

It is very important for the Medical Subordinate to understand clearly the use of and the limitations of these gangs. In the first place, he cannot too clearly understand that *these gangs must not be used as a substitute for hospital.*

(1) *The Convalescent and infirm gang.*—As its name implies, this gang should consist of those who are temporarily unfit for work after discharge from hospital, and also old and permanently unfit men. Much will depend upon the Medical Officer as to what men are kept in this gang. Personally the writer prefers to keep patients a few days longer in hospital, and a few days shorter time in this gang, but it will often be found that the change to the convalescent gang will improve a man's health and hasten his convalescence. Also there will, in every jail, be a number of feeble old

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* My experience is on the whole in favour of the issue of quinine in this way: certainly, I have never found any harm to result from it. It is useful sometimes also to divide the prisoners into two gangs, one to get the drug and one not to get it. By thus making a control experiment, the value of the drug is clearly seen, and in the following year all prisoners can get it.

men suffering from old age and senile decay rather than any disease: for this class the convalescent gang is also intended.

(2) *The Special gang.*—This is perhaps the more important of the two. In it should be kept all prisoners who have been steadily losing weight, or who are suffering from malnutrition shown in their pale anæmic appearance. They also often suffer from dyspepsia and spongy or even ulcerated gums. But as a rule all who have got any active disease are better kept in hospital.

The special privileges of these gangs are as follows :—

(1) They must be provided with an extra blanket, woollen *jangias*, woollen cap, and an abdominal belt.

(2) They must be allowed a long midday rest throughout the year (Jail Code, 968).

(3) The Medical Officer shall devise a special diet scale for these gangs, which shall be of high nutritive value, and as varied as possible. A copy of the diet scales of these gangs shall hang in the office of the Superintendent and the Medical Officer for ready reference. Especially it is necessary to issue animal food in form of meat, fish, milk or *dahi* in full nutritive equivalent for part of the *dâl* not issued (*vide* above, page 33). Potatoes and onions should also be given regularly to these prisoners. Extra oil for inunction of the body is also needed.

They shall also be given old clean rice of a better quality than that given to ordinary prisoners. The oil, salt, and condiments should be increased. For the early morning meal '*bhurtha*,' or rice, barley, sago or arrowroot cooked in milk and sweetened with sugar will also at times be found very useful.

But the important point in dieting these gangs is to remember that hard-and-fast diet scales do not suit all: hence any individual needing special diet should get it.

Where there is a sufficiently large hospital kitchen, the food for these gangs is best cooked in it under the direct supervision of the Medical Subordinate: at any rate all prisoners belonging to these gangs should be fed in the hospital compound, and the Medical Subordinate should note which prisoners do not eat all their food, and bring up his case to the Medical Officer for orders.

It is necessary to be liberal in all orders about diet for these prisoners: their food must be so well cooked and so varied from day to day that their appetites may be tempted; hence the use of different kinds of good *dâls*, good vegetables, as onions, potatoes and radishes, and free use should be made of the liberal orders of the Jail Code for the treatment of these gangs. Any specially prepared food or delicacy which the Medical Subordinate may know how to make should be given to men in these gangs. The Medical Subordinate should take a personal interest in the dieting of these men: it will well reward him.*

All prisoners in both above gangs must be weighed weekly. It is seldom wise to send a man out of these gangs till his weight has begun to rise. When a prisoner does become fit again for work, he may often be given a light or medium form of labour *for a definite period* after discharge from these gangs.

All prisoners in these gangs should be paraded, preferably in the hospital compound, for the inspection of the Medical Officer twice a week, say, on Wednesdays and Sundays.

As regards labour, it is not wise to let these gangs be entirely idle. The men in convalescent gang can usually be suitably employed in keeping the hospital wards and compound clean and tidy, and other such light labour, or some may even be able to act as sick attendants on the patients in hospital. The men in the special gang may either assist the above gang in such light work or be given light work by themselves, not mixed with other gangs, such as opening or twisting cotton yarn, weeding the garden, hair-cutting, punka-pulling, sweeping roads, etc., etc., but they should not be given "tasks." Absolute idleness is certainly prejudicial: if a man is not fit for such light labour, he should be in hospital.*

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* For some anæmic prisoners in these gangs it will be found useful to give bone marrow. This can be obtained from the butcher, who breaks the long bones and extracts the marrow. It may be cooked by frying with oil and spices.

CHAPTER XIII.

THE INFECTIVE DISEASES.

It has long been known that many diseases are communicable from one individual to another and also from animals to man. What is known as the germ theory of disease furnishes us with an explanation of these facts. This theory assumes that the contagia are living particles or organisms of a very minute size, and recognisable by sight only under a powerful microscope. The organisms are called by the general name of germs or microbes (*lit.*, little living things), or according to their shape as bacteria, bacilli (rod-shaped), micrococci (round dots) spirillæ or vibriones (of a circular or twisted shape), etc. There exist millions of harmless bacteria and plenty of useful ones, but the micro-organisms we are here concerned with are only pathogenic or disease-producing ones; as examples may be quoted, the bacillus of tuberculosis, the cholera vibrio, the bacillus of enteric fever, and the plague bacillus. The diseases which are known as the specific fevers are produced by one or other of such organisms.

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* It should be a fixed rule in every jail that any prisoner requiring any indulgence in the way of food beyond the ordinary healthy prisoners should be kept in one or other of the above gangs. Often it has been found that a prisoner will remain getting some extra or indulgence (ordered for a temporary purpose) for many weeks or months and living among the ordinary prisoners, without being specially looked after by the Medical Subordinate, who may not know whether the extra or special food ordered is doing any good or not, or if the prisoner really gets it. All such prisoners should be in one of the above gangs, and his condition carefully watched.

According to the manner in which these diseases are transmissible from one person to another, so are they spoken of as being either (1) infectious, (2) contagious or (3) inoculable.

It is, however, impossible to draw any certain distinction between infection and contagion. The word "contagion" implies personal contact, but it is difficult to name a disease which spreads only in this way. By "infection" is usually meant the conveyance of the poison in some indirect way through the medium of air, water, soil, food, clothing, etc. A disease is called "inoculable" when it is capable of being introduced into the system by some breach of the skin surface as syphilis and probably leprosy.

The following table gives a fairly complete list of communicable diseases, classified under the most usual method of conveyance:—

(1) *Contagion, usually air-borne.*

Small-pox.
Chicken-pox.
Measles.
Scarlatina.
German measles (Rothleln).
Mumps.
Whooping cough (Pertussis).
Influenza.
Typhus fever.
Plague (also inoculable).
Relapsing or Famine fever (?).
Diphtheria.
Dengue.
Ague (?).
Erysipelas (?).

(2) *Contagion, usually water-borne.*

Cholera.
Enteric (typhoid fever).
Yellow fever (?).
Dysentery, and some forms of Diarrhœa.

(*3*) *Contagion, usually by inoculation.*

Syphilis.
Leprosy.
Ophthalmia.
Malarial fevers.
Vaccinia (cow-pox).
Gonorrhœa.
Anthrax.
Glanders.

It may be noted that in the above table it is said that contagion is *usually* so conveyed. It is not to be understood that a disease can only be conveyed in this way; for example, cholera may be conveyed either by drinking-water or by flies. Ague may be conveyed either by air, by water, or by inoculation (by mosquitos probably).*

In class I. above, in which the contagion is usually air-borne, it is meant that the poison is breathed out by the patient or breathed in by the person attacked. The poison in such cases must reside either in the breath or in particles of skin or mucous membrane, which are blown about and taken in by the breath. In this way the contagion of small-pox, measles, and scarlet fever is spread.

In class II. the poison finds its way into water usually by means of the bowel discharges, and is transmitted to persons who have drank such water.

In class III. a disease is said to be inoculable when the poison reaches the system through a breach of the surface of the skin or mucous membrane. Syphilis is the best example of this kind of communicable disease.

The course of an infective disease may be likened to the growth of a plant. When seed is put into suitable soil for some time nothing apparently happens: after a few days or weeks, however, small seedlings or sprouts appear, which grow into full plants, produce seed and decay. In the same way the seed or infection of a disease having found its way into suitable soil in a susceptible individual springs into life by causing fever, etc., and in the course of a few weeks or so it decays, or the disease naturally dies out, not, however, without having left plenty of seed in the form of infective material.

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* (*Vide* below, page 101.)

This period from the absorption into the system to the appearance of the first symptom is called *the period of incubation.* It varies in every disease (just as in the garden some seeds spring up sooner than others), and it is necessary for us to know the length of this period, because if a person has been exposed to infection, it cannot be certainly known till a number of days equal to the maximum period of incubation has passed whether he will be attacked by that disease or not. The term "period of quarantine" is also used in this connection. It means the length of time that any person or persons who have been exposed to infectious disease are to be segregated or isolated, that is, kept apart from other individuals for fear of their spreading the disease to others. An example will make all this clearer. The period of incubation of cholera is usually from three to five days. Therefore if among any batch of prisoners a case of cholera has occurred, it is not certain for five days whether the others have been infected or not; consequently the others are kept "in quarantine" till a period of five days has passed. It is then safe to let them out as far as the danger is concerned of their having contracted the disease from the first case or at the same time. Another very important fact to understand is the *period of personal infection in* each disease, that is, for how many days is a person afflicted with any such disease to be considered a danger to the community in which he resides. This period varies with every disease from three weeks to two months (*vide* table below). Unless a patient is kept in hospital or otherwise isolated from other individuals for a period equal to the maximum period of personal infectivity, it is impossible to get rid of any infectious disease out of a jail. It is the want of recognition of, and want of insistence on, this fact which allows diseases like chicken pox and mumps to remain for months among the prisoners in a jail, for by keeping a case of mumps isolated for 21 days or a case of chicken-pox isolated for 21 days, the disease will be stamped out.

Disease.	Period of incubation.	Duration of personal infectivity.
1	2	3
Chicken-pox ...	10 to 14 days ...	3 weeks.
Cholera* ...	1 to 5 ,, ...	3* ,,
Diphtheria ...	2 to 4 ,, ...	6 ,,
Enteric fever ...	8 to 14 ,, ...	6 ,,
Erysipelas ...	1 to 5 ,, ...	1 week.
Influenza ...	1 to 4 ,, ...	3 weeks.
Measles ...	8 to 20 ,, ...	4 ,,
German measles ...	6 to 14 ,, ...	3 ,,
Mumps ...	14 to 22 ,, ...	3 ,,
Scarlet fever ...	1 to 6 ,, ...	6 to 8 ,,
Small-pox ..	12 ,, ...	6 ,,
Plague ...	3 to 9 ,, ...	4 ,,
Typhus fever ...	6 to 14 ,, ...	4 ,,
Whooping cough ...	4 to 14 ,, ...	8 ,,

* So Notter and Frith's *Hygiene*, page 589, but the period appears excessive. Ten days is probably sufficient.

Therefore should a case, say, of mumps or chicken-pox occur in jail, the patient must be kept isolated in a separate ward for at least 21 days. The wards for the treatment of infectious diseases should be large and well ventilated, not less than 1,500 cubic feet of air-space and 75 square feet of floor-space per sick man should be allowed. If more than one form of infectious disease occur, they should be kept in separate wards.† The presence in an individual of one disease does not necessarily exclude the possibility of his being attacked with another.

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† If night watchmen are necessary in the infectious ward, they should be chosen from prisoners who have had the disease, as is often possible.

Some diseases are what is called *endemic*, that is, they prevail more or less always owing to favouring local conditions. Thus cholera is said to be endemic in the delta of the Ganges. Yellow fever is endemic in the West Indies, and malarial fevers are endemic in many places.

A disease is said to become *epidemic* when it shows a tendency to spread over a large area or in a given community, where local circumstances are favourable. For example, cholera may become epidemic and spread from Bengal all over India, or indeed over all Europe also. Plague, again, is endemic in certain villages in Garhwal and Kumaon, but has prevailed epidemically in the Bombay Presidency and many parts of India.

IMMUNITY.

One of the most important facts in connection with the infective diseases is that one attack usually protects the sufferer from a second attack of the same affection. This immunity or protection differs much in duration in each disease: while the immunity afforded by an attack of diphtheria, pneumonia, or influenza is very slight, on the other hand that given by small-pox, typhus fever, measles, etc., is usually sufficient to last a life-time. We cannot here enter into a discussion of the obscure subject of immunity: we must be content to note the fact only.

It is owing to the recognition of this fact of immunity that the modern *serum* treatment of diphtheria, plague and other diseases is founded, *e.g.*, a horse is inoculated with the diphtheria poison, and when it has recovered the *serum* of its blood is taken, and it is found that this *serum* when injected into a human being ill of diphtheria, the disease usually ceases very soon and the patient recovers. In the same way plague *serum* has been successfully used by

Dr. Yersin and others for treatment of cases of plague in Bombay. In a somewhat similar way Mons. Haffkine's anti-cholera and anti-plague inoculation acts.

CHAPTER XIV.

The Infective diseases of Jails.

While we recognise that any disease may break out in a jail, we only here propose to make brief remarks about those most commonly found in the jails of Bengal—

(1) *Cholera.*

In the chapter on water there have been given examples of the spread of cholera by this means. Although it is agreed that in the vast majority of cases cholera is spread by means of water, it is not implied that other means are not possible. Much of the mystery which till a few years ago surrounded the spread of cholera has disappeared since it has been recognised that it is by means of water that the disease usually spreads. When it is said that cholera is a water-borne disease we mean that the water must have been polluted by some of the *excreta* of a cholera patient finding its way into the supply. The virus of the disease (the cholera vibrio or comma-shaped bacillus) is contained in the discharges from the bowels, and if this is allowed to find its way into water or if clothes soiled by the *excreta* are washed in water, this water becomes infected, and is a danger to the community using it. This water may also convey the disease by its being used for washing utensils, for cooking, etc.; the disease may also be conveyed by the medium of flies, as in the cases published of outbreaks in Gaya and Burdwan Jails.* The latter being a typical case is worth recording here. Two equally large gangs of prisoners, about 100 in each, were in Burdwan Jail: one gang fed at the hospital in the south-west corner of the jail, the other at the north-east corner. The hospital gang entirely escaped : in the other gang there were nine attacks, four of which were fatal. The water-supply was the same for both gangs, and the water was good. At this time several fatal cases of cholera had occurred in the town in some dirty huts just outside the north-east corner of the jail wall, and on the day before the outbreak a strong storm from the north-east drove myriads of flies from the infected huts outside towards the north-east corner of the jail. These flies were noticed to settle in countless number on the food exposed in plates for this gang of prisoners. In this case it is not difficult to see how flies which had been devouring the cholera *excreta* lying around the infected huts outside brought the germs of the disease on their infected legs and wings, and so infected the prisoners' food.

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* For Gaya case see *Indian Medical Gazette* for 1894; for Burdwan case see paper by present writer in *Indian Medical Gazette* for March 1897.

This case is quoted, as it may help to explain some obscure outbreaks of the disease. When therefore a case of cholera occurs in a jail, the Medical Subordinate must at once find out all details about the drinking-water, and what opportunity the patient may have had for drinking-water other than that supplied to other prisoners. The patient himself must be at once removed to the hut which is kept ready for such cases in the outer garden. The room in which the patient slept or took ill in must at once be thoroughly disinfected ;* any stools or vomit must be at once covered and thoroughly mixed with quicklime or other powerful disinfectant, and at once removed to the incinerator and burned. The patient's bed and clothes must be also thoroughly disinfected, as also those of his attendants. The other prisoners in this ward should not be allowed to mix with the rest of the convicts. The first thing to do is to change the water-supply, and also to boil it and to take care that boiled water only is supplied to the prisoners for drinking. Should more cases occur, the question of evacuating one or more wards is to be considered by the Medical Officer, and all wards in which cases have occurred should be thoroughly disinfected and limewashed. The question also of having those prisoners who are willing to be inoculated against cholera by Mons. Haffkine's method is also to be considered. It is here most strongly recommended; it is certainly harmless, and there is much evidence in favour of its protective power. The Medical Subordinate will show a good example by allowing himself to be inoculated.

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* For means of disinfection *vide* chapter below. The Medical Subordinate must carefully study paragraphs 991 to 1039 of the Jai Code.

The rules for management of a so-called "cholera" camp are given in the Jail Code.

In times of cholera prevalence it is very important to attend at once to all cases of diarrhœa, and all suspicious cases of diarrhœa should be treated outside the jail in the cholera huts. The prophylactic issue of dilute sulphuric acid in doses of 15 minims to each prisoner has been recommended at such times. It can easily be combined with or substituted for the prophylactic issue of cinchonidine.

Enteric Fever.

Enteric (or typhoid) fever is a disease which is rare in Bengal jails as it is rare among the outside native population of India. In India the disease is chiefly met with in military cantonments, where it attacks young soldiers fresh out from Europe. It is possible that there is a considerable amount of enteric fever among native children also which is not recognised, and is called by other names as "remittent fever," "gastric fever," etc. It is now generally believed that the disease is usually spread by means of drinking-water into which the specific virus of the disease has found entrance. The poison or enteric bacillus is found chiefly in the bowel *excreta*, and it is when this fœcal matter finds its way into sources of drinking-water that the disease becomes diffused. The obvious precaution therefore is to thoroughly disinfect and burn all stools of patients suffering from, or suspected to be suffering from, this disease.

Measles.

This is a very universal disease. It is found in almost every country in the world. Although the micro-organism of measles has not been certainly identified, it is agreed that it is a specific disease. The infection is probably given off by the breath and by the peeling off of the skin. The poison is undoubtedly air-borne, tends to cling to clothes, etc., and to hang about ill-ventilated rooms. There is no evidence of measles being spread by either food, milk or water. Infection is acquired by inhalation. The period of incubation varies from 8 to 20 days. The period of infectivity, during which the patient is capable of infecting others, is about four weeks from date of first symptom. One attack of the disease usually affords a life-long protection. Isolation of the sick is necessary, inunction with carbolised oil or vaselin, and disinfection of all clothes is necessary. The disease is very seldom fatal in India.*

Scarlet Fever (also called Scarlatina).

This is a very rare disease in Natives of India, and does not concern us here. It has a bright red rash, differing from that of measles. The contagion is chiefly given off during desquamation of the skin. It is a very infective disease, and is often attended by a high rate of mortality. Epidemics of scarlatina have in England been traced to the milk-supply.

Antiseptic inunction and general disinfection are very necessary in this disease.

Mumps.

Mumps is a very common disease in Bengal jails. It is an acute febrile disease, attended with swelling of the parotid glands. Mumps rarely attacks the same person twice. It is very infectious, and usually prevails in an epidemic form. The infection is said to be given off by the breath. The period of incubation is from 14 to 22 days. Not uncommonly the disease suddenly appears to leave the parotid gland and attack the testicle, and when the orchitis subsides the parotid gland may again become swollen. The period of infectivity lasts for about three weeks, and patients should not be allowed to leave the isolation ward under 21 days.

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* Another disease, known as Rotheln or German measles, is sometimes met with. It is very difficult in dark skins to distinguish it from measles. It is infectious, but is generally of a very mild nature.

Chicken-pox (otherwise called Varicella).

This disease is absolutely distinct from small-pox: it is in no sense a mild form of small-pox. It occurs in an epidemic form. In India it is generally a very harmless disease. The characteristic rash appears in the form of successive crops of red spots, which in the course of a few days become vesicles and scabs. The symptoms are generally slight and not important, but the severity of the attacks varies much in different outbreaks. The spots may vary in number from 20 to 200. They come out in fresh crops every day.

Usually there is some febrile disturbance. The rash may also appear on the tongue, mouth, and throat. The period of incubation is 10 to 14 days, and the person is capable of spreading the infection for at least 21 days.

It is sometimes necessary to diagnose cases of chicken-pox from small-pox, especially from small-pox in a person in whom the protection afforded by vaccination had worn out.

Isolation for not less than 21 days and antiseptic inunction* are absolutely necessary.

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* For bodily inunction in cases of small-pox, chicken-pox, scarlet fever, and measles the following antiseptic oil is recommended:—

R—

Carbolic acid	...	ʒi.
Eucalyptus oil	...	ʒiii.
Olive oil ad	...	ʒviii.

CHAPTER XIV.

Small-pox.

This is a very ancient disease, and has been known in India for many thousand years. At the present day its prevalence among any community is in inverse proportion to the thoroughness with which vaccination is carried out. It is probable that all coloured races are specially susceptible to small-pox. Small-pox is a very infectious disease: it is spread from the sick to the healthy mainly by means of the air. It can also be carried in clothes, bedding, furniture, etc. Neither water nor milk has been shown to be capable of carrying the disease. Small-pox has been shown to be capable of being spread by air for one quarter of a mile,—this at least has been proved with regard to one London small-pox hospital. It is therefore necessary to isolate small-pox cases at a distance of not less than 500 yards from all other inhabitants. The incubation period is 12 days, and the period of infectivity is at least 6 weeks (42 days) in severe cases. In even the mildest case strict isolation must be enforced for at least 21 days, and always till every scab on the skin has completely disappeared. After exposure to infection not less than 12 days' quarantine or segregation is absolutely necessary. Small-pox usually is seen in two forms—(1) mild attacks and (2) confluent attacks. In protected subjects the disease is usually of a mild type.

Small-pox in an unprotected community is a very fatal and severe disease.

Protection against small-pox.

An individual can be protected against small-pox in three ways :—(1) by a previous attack, (2) by inoculation, (3) by vaccination.

Inoculation.—This custom has been in vogue in eastern countries for many centuries, and is probably in great part responsible for the great devastation caused by small-pox. Inoculation consists in inserting some of the small-pox material obtained from a pustule into the skin, usually of the forearm. This gives rise to a genuine, though often mild, attack of small-pox; consequently in the endeavour to save an individual from an attack of natural small-pox, inoculation causes him to become a centre for the spread of the disease. It is also dangerous to life. Inoculation against small-pox is now illegal in all civilized countries, but that it was in common practice in India till recent years is seen by the number of adult prisoners who bear marks of inoculation.

Vaccination.—The practice of vaccination was introduced in 1796 by Edward Jenner. He found that human small-pox and cow-pox were identical diseases, and that if human beings were inoculated with cow-pox (vaccinia), they became protected against ordinary human small-pox. Jenner claimed that vaccination carefully and efficiently performed will protect the constitution from subsequent attacks of small-pox as much as an attack of the disease itself will.

It is impossible here to show by statistics the very great decline in small-pox in those countries in which vaccination is thoroughly done. Not only has the disease to a great extent disappeared from vaccinated countries, but the mortaltiy of the cases when the disease does appear is in inverse proportion to the number of vaccination points. Vaccination is for a time protective against itself as well as against small-pox. The duration of the protection is directly proportionate to the number and size of the vesicles produced. Very few persons are insusceptible to revaccination after a lapse of ten or twelve years: many are even susceptible after only five years. Therefore vaccination in infancy is not sufficient to confer a life-long immunity. It is found, however, that re-vaccination at puberty will practically render the subject safe from small-pox for the rest of his life. In Germany, where revaccination at puberty is a necessary condition of entering the Army or obtaining any public employment, it has been found that this compulsory revaccination has had the effect of almost totally banishing small-pox from Prussia. In all Bengal jails vaccination or revaccination is compulsory for all newly-admittted prisoners; and notwithstanding the prevalence at times of small-pox in the communities from which the prisoners come, small-pox is a very rare disease in jail and its spread in a jail is a still more rare event. Another point may be noted. As the incubation period of vaccination is only 7 days, while that of small-pox is 12 days, it is possible to protect by vaccination those exposed to infection on the third, fourth, or even fifth day after that exposure. Thus if a case of small-pox is discovered in a ward, it is possible to counteract the danger by vaccinating all the prisoners in that ward within three or four days of the exposure to infection.

It is obvious that the most rigorous isolation is necessary for a small-pox patient, and all his attendants should be revaccinated at once.

Typhus Fever.

In pre-sanitary days this disease was called "jail fever" owing to its prevalence in prisons. It is a comparatively rare disease now in any country. In India its existence has been certainly proved, but it is chiefly found in Peshawar and other frontier stations. I believe it is unknown in Bengal. It is a very fatal and very infectious disease. The poison is given off by the breath and skin, and readily attaches itself to clothes, bedding, etc. The poison is, however, rapidly diluted by plenty of fresh air. Typhus is usually found in association with poverty and overcrowding. A second attack is very rare. The duration of personal infectivity is not less than one month.

Plague.

Had this book been written before September 1896, the disease known as plague would not have found a place in it. Till the recent outbreak of the disease in Hong-Kong, China, in 1894, the plague had almost become unknown. It is one of the oldest of diseases, but in recent years it has only been known in India as endemic in the hills of Garhwal and Kumaon. It is not here necessary to tell the history of the disease. Its severe prevalence in 1896-97 in Bombay and Western India generally have made it familiar to all.

As the disease has not been studied by modern methods till the last few years, we are yet in some doubt as to the means of spread of the disease, and some perhaps hasty writers have thrown doubt upon the infectiousness of the disease. It is, however, safer for us to rely upon the observations of older writers, to whom the disease was an every-day familiar thing, as well known as cholera is to us in India to-day.

Plague is said to be endemic in two localities, viz., the Lower Euphrates Valley (Persia) and in Southern China. It is probable that the disease is also endemic among the inhabitants of Thibet and the Upper Himalayas. Plague is a specific disease, the bacillus of which has been recognised, and which can easily be detected in the blood and in some secretions. All historical evidence points to the intense contagiousness of plague among people living in overcrowded, ill-ventilated houses, and surrounded by dirt and accumulations of filth. It is certain that in time of plague or before an outbreak, rats and other rodents die in great numbers. There is also some as yet unexplained connection between plague and the storage of grain. The bacilli have been discovered in the dust of floors.

Owing to this uncertainty about the method of spread of the disease, it is not easy to lay down certain rules for arresting it.* Isolation of the sick is certainly imperatively necessary, and their removal from their usual dwelling-places. Plenty of fresh air is certainly useful, as is thorough cleanliness and good sanitary measures. Where there is dirt plague will certainly flourish. Should a case of plague be admitted to a jail, it would be necessary at once to remove the patient to a hut in the garden, to isolate all those prisoners who had associated with the patient up to the time of the attack, to thoroughly disinfect the patient's clothes or to burn them, to disinfect the ward. As the incubation period is usually from 3 to 9 days, it is necessary to isolate those who have been in contact with the sick man for not less than nine days; probably ten days would be safest.

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* The evidence in favour of the view that the plague germs are spread and carried from place to place by rats is very strong, and if plague is expected, a vigorous war against rats should be organised ; there is also very strong evidence to show that the plague germ can enter the system through sores, cuts or abrasions of the skin. In the pneumonic form the germ probably enters by the breath in dust, &c.

Should plague be prevalent in the neighbouring town or district, it is necessary to have all prisoners coming from Court, whether under-trials or convicts, at once disinfected, and their clothes taken from them, and new clothes given them before being passed through the jail gate. At such a time the most scrupulous attention must be paid to all sanitary regulations in force, and a careful medical inspection made of all new arrivals. Any prisoner suffering from fever or from enlarged glands (buboes) should be kept isolated in some building outside the jail till the nature of the disease declared itself. Preparation must also be made, as laid down for cholera epidemics, for the possible removal of some of the prisoners into camp. A very fatal form of plague is the pneumonic, in which the lungs are the chief seat of the disease. It may therefore be confused with ordinary pneumonia with very serious results.

Pneumonia.

It is now a generally accepted opinion that the disease of the lungs called pneumonia is not a mere inflammation of that organ, but a specific febrile disease. With a discussion of this view we are not here concerned. There is also a form of pneumonia which prevails in an epidemic form, under conditions which are strongly suggestive of infection. Such epidemics have been described both in Europe and in

India. Clinically the symptoms are identical in both forms. Exposure to cold and wet has usually been considered as the cause of the disease, but it is probable it only acts as a direct predisposing cause. In malarious subjects pneumonia of a severe form is easily excited by sudden cold and chill. Insanitary conditions, such as overcrowding and want of ventilation, also predispose to the disease. There is also a severe form of pneumonia, which is often seen in cases of influenza. The incubation period is from 5 to 7 days. Both breath and sputa may be assumed to be infective, and the latter should be received in vessels containing a disinfectant.

Influenza.

Since the year 1889 this disease has again appeared, and has spread right round the civilised world. Up till that year the disease had almost been forgotten. There is no doubt that influenza is a regular specific febrile disease which for years disappears and again appears to remain for more or less long periods. Since 1889 it appears to have regularly attacked the prisoners in Bengal jails. It appears to come at two distinct periods—at the beginning and at the end of the cold weather. It is, however, at these periods that the diurnal variations of temperature are greatest, and it is possible that many cases of bronchitis are called by the name of influenza.

The following considerations lead one to suppose that an influenza epidemic is to be dealt with :—

(1) Sudden occurrence of numerous cases of bronchitis, fever, and intense prostration.
(2) The great debility and prostration accompanying the attacks.
(3) The occurrence of pneumonia in the course of such cases.
(4) The prolonged weakness and slow convalescence.
(5) A history of the disease in other places at the same time.

Ætiology.—The period of incubation is short—from one to three days. The infection is probably given out by the breath. The sputum is probably infectious, and should be treated as such. Patients should, as far as possible, be isolated—certainly they should be kept apart from the other sick. The use of Eucalyptus and other strong-smelling disinfectants is usually recommended. As convalescence is slow and the patient is probably infectious for about three weeks, no patient should be discharged from hospital under 21 days.

*Cerebro-Spinal Fever.**

This is an acute fever of somewhat rare occurrence. It has been found chiefly in the central jails of Bengal. It has also been noted in certain Punjab and Bombay jails, and is still frequently met with in emigrant ships sailing from Calcutta to the West Indies, and in emigration depôts.

The invasion is generally sudden, strong healthy men being as liable to attack as the weakly. The temperature rises suddenly to 104°F. or 105°F., but may fall to normal or near it the next day, or remain for several days between 100° and 103°F. Vomiting at the onset is common. Delirium soon supervenes; deafness is common. The conjunctivæ are injected. Prostration is great. Headache is frequently complained of, and very often pain and stiffness of the neck. Retraction of the head is present in most cases. In some cases contraction or spasm of muscles is seen. The tongue is usually covered with thick fur, and is moist. Breathing is usually rapid; in cases where pneumonia is also present, the respirations are extremely frequent. Bed sores are liable to form. Constipation is usual, and retention of urine not infrequent. No eruption has been noted in cases in India, except a slight herpes on lips. Death is usually ushered in by coma. The prognosis is unfavourable; a very large percentage of cases die. Death may take place in a few hours, more usually within seven days, but some cases last for several weeks. Convalescence is always slow. The disease apparently is found at all seasons; some epidemics have been met with in May and June, others from September to November, and in the Punjab from November to February.

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* *Vide Indian Medical Gazette* for September and December 1899 and June 1900.

Kernig's symptom is very useful as an early aid to diagnosis. It is as follows: When the patient sits up, he is unable to extend fully his legs, owing to the contracture of the hamstring muscles. He can extend them fully when lying down in bed.

Post-mortem appearances.—Brain, marked congestion in all cases and usually distinct exudation of yellowish purulent lymph on the surface of the brain, and extending down past the medulla oblongata to low down on the spinal cord. The lateral ventricles frequently contain turbid fluid. Other organs are not characteristic. Usually fluid is found in the pericardium, and frequently the lungs are found in a state of pneumonic consolidation.

Ætiology.—Little is known of the causation of this fever. It usually appears in an epidemic form, usually attacking prisoners in jails or men in barracks. Overcrowding and bad ventilation appear to be strong contributing causes, though a severe epidemic occurred in Hazaribagh Jail in 1889 when it was almost empty. In Bhagalpur Jail a connection has been traced between cases of this fever and dusty forms of labour, either in the Jail garden or in grain-grinding sheds. The dust may be the vehicle of the germ.

Treatment.—No special treatment is of any avail. All cases should be treated as infective and rigorously isolated. Overcrowding and bad ventilation of sleeping wards and worksheds must be avoided.

OTHER DISEASES.

We next come to a class of diseases which are not so commonly classed as infective. That they are infective in the sense of being communicable from man to man is probable, but nevertheless they differ from the acute febrile specific diseases, such as leprosy, tuberculosis, dysentery, and malarial fevers.

Leprosy.

This is a chronic communicable malady characterised by either the presence of tubercular nodules in the skin and mucous membranes or by degenerative changes in the nerves.

Leprosy is one of the oldest known diseases. In India the disease is very common. Lepers are, however, not often seen in jails. When they do come they are (in Bengal) sent to the special leper wards either in the central jail at Midnapore or to the jail at Muzaffarpur. The disease is known to be due to a bacillus which flourishes under conditions which can only be described as obscurely known. It is probably communicated by contagion, but in the sense that tuberculosis or syphilis, not as small-pox or measles, are spread. Unless it is contagious it is difficult to explain its rapid spread in newly-affected communities, as in the Sandwich Islands. That a tendency towards the disease is strongly hereditary is probable and a view supported by much evidence. It has been attributed to the use of certain articles of food, *e.g.*, fish, but the disease prevails widely among communities who seldom eat fish. It is certain that strict isolation and the prevention of the marriage of lepers would go far to stamp out the disease. Certainly no leper should be allowed to sell or handle food, nor should they be allowed to follow the occupation of washerman or barber.

In jails one unobjectionable form of labour is *surki* pounding for such as are capable of it. It is probable that leprosy is only communicable when in the ulcerated state.

Tuberculosis.

Tuberculosis is found in many different forms. When its seat is in the lungs it is known as phthisis or consumption: when it attacks the lymphatic glands it is known as scrofula or strumous disease; or when the mesenteric glands are involved as tabes mesenterica. When the brain membranes are attacked the disease is known as tuberculous meningitis.

Tuberculosis is a disease of all countries, but is perhaps more severe and prevalent in cold climates than in the tropics. In India it is frequently found especially among the hill tribes. It is also very common in Bengal. The cause of the disease is the bacillus tuberculosis discovered by Koch.

Of all predisposing causes a hereditary predisposition is perhaps the most important. Overcrowding and the habitual breathing of impure air are certainly potent factors in the spread of the disease. As regards direct contagion, definite evidence is wanting. It is probable that it can sometimes spread by infection from case to case. The inhalation of irritating dust, etc., in crowded workshops and factories is certainly productive of the disease. The former great prevalence of the disease in armies, factories and prisons was certainly associated with overcrowding, and was due in great part to the breathing of dust infected with dried tuberculous sputa, etc. The open-air treatment is now the fashion, and it is certainly founded on accurate knowledge. Open air, plenty of food and drugs for special symptoms,—this is the modern method of treatment. The disease is more common in Bengal than is generally suspected, and often runs a latent course, the patient's attention being devoted to the diarrhœa or emaciation only.

Malarial Fevers.

The diseases which are usually regarded as malarious are intermittent fever (or ague), remittent fever, and the condition known as malarial cachexia. The Medical Subordinate will do well to remember that ague is a distinct type of disease accompanied by intermittent fever. The word "ague" is not a mere scientific translation of the vernacular word for "fever." Fever is only a symptom in many diseases, of which ague is one. There is, however, no doubt that fevers due to malaria are the most common of all fevers in India and in tropical countries, and, moreover, the malarial poison in the system strongly predisposes to other diseases, as dysentery, pneumonia, asthma, rheumatism, anæmia, etc. What is malaria? The word means literally "bad air," but is generally used to cover all climatic influences which are associated with or influence attacks of intermittent or remittent fevers. It is now very generally agreed that malarious fevers are due to the presence in the blood of a certain parasite known as the amœba of Laveran, it having been first fully described by Laveran, a French Army Surgeon, in 1880. This parasite appears in various forms: it is not certain whether there is more than one form of the parasite or whether the differences are due to different stages of development of a single parasite. Under a high power of the microscope, this parasite can be seen within the blood corpuscles. The parasite has not yet been discovered *outside* the blood, except in its process of development in the body of the mosquito.

Fevers of a malarial type are found in countries and places which differ very much from each other. A damp soil with much decaying vegetable matter is usually regarded as specially malarious, but the disease is also found in large open sandy tracts in the Punjab and other places, which differ much from places ordinarily understood to be malarious. There is no doubt, however, that dampness of the soil from recent rain or from a high level of the subsoil water is strongly provocative of the disease, but it is usually on the drying up of the soil after rain that malarial fevers abound. In India malarial fevers prevail most in the autumn when the soil is beginning to dry after the monsoon rain, and when the cool nights following on hot days cause chills due to imperfect protection against the daily variations in temperature. Land which has been long out of cultivation is usually malarious, and severe outbreaks of the disease often occur when land is dug up for building and other engineering purposes. The evidence in favour of malarial fevers being conveyed by use of drinking-water has been detailed above in the chapter on water (page 25). Malaria cannot be said to originate in jails or to be due to any condition of jail life. All prisoners have suffered more or less from malaria before their admission to jail.

Malaria.

Since the first edition of this little book has been published a great deal of work has been done, which shows us not only one means of spread of the malarial fevers, but also opens up to us a method of prevention. The mosquito malarial theory is briefly as follows:—The germ or hæmamœba of malarial fever is a parasite of a low order, the sporozoa. If one examines under the microscope a drop of blood from a patient suffering from malarial fever, one can see the germ or parasite within the red blood corpuscles. If the blood be examined an hour or so before the expected attack of fever, the parasite will be seen as a pale ill-defined disc of protoplasm inside of a red blood corpuscle. Scattered throughout this pale body are a number of particles of intensely black pigment (melanin). If the blood is examined in this way at intervals, it will be seen that the little disc inside the blood corpuscles undergoes changes in shape, the scattered dots of pigment become concentrated, and the disc arranges itself into minute segments of a globular form, the enclosing wall of the corpuscle then ruptures, and the globular segments or "spores" become free in the liquor sanguinis. There are several species of these parasites corresponding to the types of fever, irregular (or aestivo-autumnal), tertian or quartan, and it is possible from the appearance of the parasite to diagnose both the stage and the type of the fever. It is now taught that there is no special parasite of "quotidian fever," but that this fever is due to two breeds of the parasite, each keeping its own time, thus while in true tertian we have fever only on the first, third fifth, and seventh days, in quotidian we have one brood of germs producing fever on the first, third, and fifth days, and another on the second, fourth and sixth days, etc., so that as far as the temperature chart and the clinical symptoms go, we have daily or quotidian fever.

The old clinical distinctions of the malarial fevers are now-a-days to a great extent given up by some writers, and according to them the malarial fevers are to be classified as follows:—

Benign ...	Quartan. Tertian.
Malignant or aestivo-autumnal.	Quotidian. Tertian.

The obscure and confusing term "remittent fever" is abolished. As a matter of fact, the intermittency or remittency of a fever depends, in great measure, on the simultaneousness or the reverse of the maturation of the crowds of parasites in the blood; if they are of different ages, they mature at different times, and we have a remittent fever or a continuous fever; if the parasites are of the same age, they all mature about the same time, and we have an intermittent fever. It is also important to know that the low fever of chronic malaria does not follow any of the above types; it is quite secondary; it is not due directly to the parasites in the blood, but to toxins or poisonous products manufactured by the parasite. Consequently, it not being dependent upon the parasite living in the blood, it is not specially affected by quinine. This is in agreement with clinical experience.

So much for the amœba or germ of malaria. We now come to its means of spread.

It was found by Dr. Manson that if blood be examined some ten minutes or so after it is drawn, there will be seen what is known as the "flagellated body." This is a body with thin actively moving legs like the lash of a whip (whence the name *Flagellum*). These legs or whips become detached and free in the blood, and this stage of development of the parasite is not found in freshly drawn blood. This evidently points to their having some special use or meaning, and Dr. Manson surmised that they were connected with the life of the parasite outside the human body.

He also having previously worked out the connection between the mosquito and elephantiasis suggested this insect. The theory was taken up by Ross, who soon was able to bring forward a large amount of evidence in favour of the connection between the mosquito and malaria. His work was continued by Italian and German workers with the result that now it has been well nigh proved, in fact malarial fevers have actually been given to a patient, who was entirely removed from all malarial influences, by the direct bites of mosquitos brought from a well-known malarious locality near Rome.

Ross showed that in what is called the malaria of birds he could trace the malarial germ from the body of the bird to the poison gland and proboscis of the mosquito.

This theory, therefore, now stands that malarial fever can be conveyed by the bite of certain species of mosquitos from a sick to a healthy person, that is, that this insect can suck up the parasite of malaria from a sick person, and that the germ undergoes development in the body of the mosquito till it is in a state to be injected into the system of the next person that the mosquito may happen to bite. This much at least has been proved, which is more than can be said for any other of the numerous suggested methods of malarial infection. It has so far by no means been agreed that this is the only way that malaria can be conveyed from one person to another; it is possible, for example, that if the mosquito dies or even breeds in water that the drinking of this water may also convey the disease. Moreover, it must be remembered that many of the cases of malarial fever which we see are not so much new infections by the mosquito as relapses from former attacks, which may be brought about by slight causes, such as chills, exposure to cold or heat, etc.

It is, moreover, agreed that it is not every form or species of mosquito that can convey the malarial parasite: it is only a few species, of the *genus anopheles.* Hence it becomes very important to recognise this genus. One ready means of recognising this genus is that while the non-malarial mosquito sits on a wall or other flat surface with its body parallel to the wall, the anopheles always holds its body at right angles to the wall. This any one can easily ascertain for himself.

As then the anopheles is a common means of spreading the malarial fevers, it is obvious that if we could destroy all this genus of mosquito, we could thus banish the malarial fevers. Therefore the extermination of malaria to a great extent means the extermination of the mosquito. The habits therefore and its mode of life must be studied, and Major Ross, as one result of his journey to the West Coast of Africa, has announced that the malarial species of mosquito chiefly inhabits small pools and puddles of water, which could be without difficulty closed up. This is probably the case for the West African variety of the anopheles mosquito, but recent observations in India tend to show that the anopheles also lives and breeds in the water of rice-fields and tanks; if this observation is confirmed, it is obvious that its extermination will prove to be more difficult than was at first expected.

In jails, however, it will be not a difficult task to endeavour to destroy the breeding places of the mosquitos: pools and puddles can be filled up and tanks kept clean and full of fish. It also becomes the duty of the Medical Subordinate in the jail to search for the haunts and breeding places of the mosquito, and when found to destroy the larvæ. At least there is more hope of conducting this experiment successfully inside a jail than outside in a town.

The effects of malaria are seen in the occurrence of fevers of an intermittent or sometimes of a remittent type, also in enlargement of the spleen, in anæmia, and persons who have suffered much from fever of this kind are apt to pass into a condition of malarial cachexia, in which we find a bronzed ashy colouration of face, yellow jaundice-like conjunctivæ, more or less anæmia seen in a pale skin and mucous membrane, œdema of feet and ankles, puffiness of lower eyelids—it may be ascites. There will in such cases also be found a scurvy-like ulceration or spongy condition of the gums or an ulcer (described by Dr. Crombie) between the upper and lower molar teeth of one or both sides of the jaws. The tongue may be flabby and marked with black pigment patches, or it is often red, raw, glazed and fissured. Such patients are very liable to attacks of so-called chronic dysentery or diarrhœa, or they are apt to be carried off by an attack of pneumonia or of œdema of the lungs. Albumen is sometimes found in the urine; the spleen is usually enlarged, often to an extreme extent, and liable to rupture on the occurrence of comparatively little violence.

Asthma and rheumatism are also very common diseases in malarious climates.

Prevention.—All we can do in jails to prevent malaria is to keep the soil dry by good drainage, etc., to keep the floor of worksheds and wards free from damp, to avoid chills by suitable clothing, and to prevent attacks of fever by the prophylactic issue of quinine or cinchonidine; and destroy all possible haunts of the malarial mosquito.

Diarrhœa.

Diarrhœa is in reality only a symptom of intestinal irritation, and consequently is the result of many causes. It occurs in jail, as among the free population, in many forms. It appears certain that in a malarious climate persons are very liable to attacks of diarrhœa from slight causes, such as chills, indiscretions in diet, *i.e.*, over-eating or eating badly-cooked food, drinking muddy water, etc., etc. In jails there is a common form of diarrhœa which is often alarming, viz., a loose, watery diarrhœa, in which the patient becomes almost collapsed. This is frequently produced accidentally or on purpose by the eating of indigestible raw grain (wheat, *dál*, etc.), unripe or over-ripe fruit. It is specially frequent in the hot weather and rains. In (so-called) chronic dysentery cases diarrhœa often alternates with the dysenteric attacks. When there is a general prevalence of diarrhœa among the prisoners of a jail, the greatest care and forethought is necessary. All cases should be at once sent to hospital for observation, and at once treated by a dose of astringent mixture. All prisoners wishing to go to the latrine "out of time" (*i e.*, at other times than the regular parades) should also be sent to hospital. The Medical Subordinate at such times must pay particular attention to the preparation and cooking of the prisoners' food. The rice should be old rice, not less than three months' old at the least, and should be carefully cleaned. The *dál* should be cooked till it is quite soft. Stringy, fibrous parts of vegetables should not be used.*

Dysentery.

This is perhaps of all diseases the one in which we are most interested in jails. It is to dysentery that a great part of the jail mortality has been in past years due. It is therefore specially necessary for the Medical Subordinate to take great care in the prevention of this disease.

In the present writer's experience dysentery is met with in three forms in Bengal jails, viz., mild, acute, and chronic.

Mild Dysentery.

A large number of dysentery cases in jails come under this heading. The patient comes to hospital complaining of passing blood and mucus in his stools. The stools are scanty, and at first contain no fœculent matter, only rose-coloured mucus. The bowels may be moved from 4 to 20 times a day, and there is considerable pain and straining. Under simple rest in bed, bland, unirritating food, and a dose of castor oil, such cases generally recover quickly.

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* Once during a storm in the Central Jail, Midnapore, the cooks left the cook-house to take shelter, and the food was issued badly cooked, with the result that the next morning no less than 125 prisoners came to hospital complaining of diarrhœa.

These attacks are brought on by slight causes, as chills due to changes in the temperature, *e.g.*, warm days followed by cool nights, wet clothes, irregularities in food, etc. Such attacks are most common in unhealthy (*i.e.*, malarious) years.

Acute Dysentery.

This is the acute specific disease described in the text-books of medicine. It is usually said to be due to a specific amœba, which, however, has not been certainly identified. The symptoms are similar to those in the mild form of the disease, but are much more severe, and are accompanied by fever, great pain, and prostration. The disease is frequently fatal.

We have already (Chapter VII) shown the connection between this form of disease and an impure water-supply. It can also be produced by careless methods of sewage disposal.

It is against this form of dysentery that the strict rules of the Jail Code are in force. All such patients should be separated from the other sick prisoners. All their stools must be at once disinfected by lime or other powerful disinfectant, and at once removed to the incinerator and burned.* The patient's clothing and bedding must be frequently changed and disinfected. The ward in which dysentery cases are kept should be limewashed once a month, and the floors and all furniture carefully and frequently washed with a strong disinfectant. If many such cases occur in a jail, the water-supply must be suspected, and if possible, changed or disinfected. The same care and attention to cooking, etc., of food is necessary in these as in the milder forms of dysentery. Overcrowding must be strictly avoided in a dysentery ward, and the ventilation must be ample. The Jail Code rules for the disposal of all night-soil must be strictly adhered to. The trenching ground must be carefully supervised, and care taken that no night-soil is buried near any possible source of water-supply. Cess-pools or accumulations of rubbish and filth must never be permitted.

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* In fact, in jails all dysenteric stools (of whatever form of dysentery) must be disinfected and burnt.

Chronic Dysentery.

The third form of dysentery found in jails is what is commonly known as "chronic dysentery." It is to this form of dysentery that the jail mortality from the disease is chiefly due. This form is chiefly found in connection with cases of malarial cachexia, tuberculosis, or scurvy. In persons suffering from the above diseases an attack of dysentery, at first apparently mild, is found not to respond to treatment, and a chronic state supervenes, in which chronic diarrhœa and dysentery alternate. The other symptoms of malarial cachexia (page 106 above) will also be more or less present, or symptoms of tubercle of the lungs or of scurvy may be noted. Such cases are very tedious, and often linger on for months. Ordinary treatment directed to the dysentery is of little avail. The patient dies ultimately either of exhaustion or from some intercurrent complaint, as pneumonia or œdema of the lungs.*

Terminal Dysentery.

Another form of dysentery is what I have described (*British Medical Journal*, September 9th, 1899) as "terminal dysentery." It supervenes only in the last stages of chronic diseases, and is a certain sign of death within a few weeks. It should always be looked for in all chronic cases of disease, such as malarial cachexia, tuberculosis, syphilis, &c.

Treatment of Dysentery.

Dieting is of the greatest importance. Recently I have treated all cases in the acute stage with *mar* and *dahi.* The

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* For a detailed account of the present writer's views on dysentery in jails, *vide Indian Medical Gazette*, May and June 1897.

mar must be specially made with good clean rice (3 seers rice to 1 seer water). Plenty of milk is necessary for chronic cases, and Dr. Ashe recommends the use of flour made from dried plantains.

For drugs I now almost entirely use sulphate of soda or sulphate of magnesia in a saturated solution. This should be given in small, frequently repeated doses, till the stools are free from blood and mucus. The stools must be seen daily.

Prevention of Dysentery.

Endeavour must always be made to prevent dysentery. This can only be done by attention to the water-supply, the cleaning and preparation of the food (and vegetables), and above all to the cooking. The Medical Subordinate must never neglect even the mildest case of dysentery: he should admit at once all such to hospital, and treat them carefully, and should not discharge them till every trace of blood and mucus has for several days disappeared from the stools. This will prevent relapses, for dysentery is a very relapsing disease, and it will decrease the number of chronic cases, and thus keep down the Jail death-rate from dysentery.

CHAPTER XV.

DISINFECTION.

By the term disinfection is meant the destruction by means of chemical or other agents of the specific poisons of disease.

Disinfectants are chemical substances which can destroy specific poisons. Deodorants are substances which oxidise the products of decomposition, and thereby remove offensive odours. Antiseptics are substances which suspend the vitality and power of multiplication of micro-organisms, thereby preventing decomposition.

The principle of disinfection is to attack and destroy the specific poisons of disease at their seats of origin, thus, for example, the poison of scarlet fever or measles is destroyed by oily inunctions of the skin, the poison of cholera by adding disinfectants to the stools which contain the specific virus. Disinfectants are of two kinds—physical and chemical. The chief physical disinfectant is heat; the chief chemical agents are perchloride of mercury, carbolic acid, and chloride of lime.

But in addition the importance of fresh air and sunlight as disinfecting agents must not be overlooked.

Heat as a Disinfectant.

Heat is used as a disinfectant in three forms—as (1) dry heat, (2) as moist heat or steam, and (3) in the form of boiling water. Dry heat is inferior to moist heat as a disinfectant. As a general rule, it may be said that boiling for 15 minutes or exposure to moist heat (steam) for one hour will render any article absolutely free from infection. The greatest difficulty in the use of heat as a disinfectant is that many articles are destroyed by its use, but this objection does not hold good in considering the disinfection of jail clothing.

Chemical Disinfectants.

There are many substances which are claimed as powerful disinfectants. Practically speaking, chemical disinfectants are of two kinds—liquid and gaseous.

The chemical disinfectants generally used in the liquid form are as follows:—

Liquid Disinfectants.

(1) Perchloride of mercury (or corrosive sublimate).

This is a highly poisonous salt. It should be used in the strength of 1 in 1,000, or better according to the following recipe:—

Perchloride of mercury ...	½ oz.
Hydrochloric acid ...	1 "
Aniline blue	5 grs.
Water	3 gals.

The addition of aniline blue is for the purpose of colouring the mixture, so that the solution may not be used by mistake for other purposes.

(2) Carbolic Acid or Phenol.

This is used in the strength of 5 parts to 100 parts of water (5 per cent., or 1 in 20). Numerous preparations of carbolic acid are in use in the form of carbolic powder, disinfectant powders, etc., but they are comparatively inert.

(3) Izal. This is a non-poisonous white fluid. It is a powerful disinfectant in a strength of 5 parts to 100 of water (1 in 20).

Gaseous Disinfectants.

The gaseous or aërial disinfectants in common use are chlorine and sulphurous acid (sulphur). It may be stated that for practical purposes in jails these aërial disinfectants are an utter delusion, but an immense amount of tradition and superstition still lingers around their use. Besides, aërial disinfection is a misnomer, because we do not want to purify the old air, which should be wholly removed by ventilation. Most certainly the handful of sulphur burned in an open vessel in the ordinary jail sleeping ward is an absurdity. It is only when the room to be disinfected can be hermetically sealed that sulphur can be of the slightest use, and to so thoroughly close up a jail ward is practically impossible. If, however, the Medical Subordinate is directed to use sulphur fumigation, he must attempt to do it in as thorough a manner as possible. First the walls and floors of the ward are to be damped with water, then all doors, windows, and ventilating openings are to be tightly closed, and sulphur moistened with methylated spirits is to be burnt in the room. The quantity usually consumed in a jail ward is utterly useless: not less than 3 lbs. per 1,000 cubic feet of air-space (that is, for a ward containing 20 prisoners about 30 lbs. of sulphur) must be used; the sulphur should be broken up in small fragments and several vessels used. The ward should not be opened for several hours after.

Chlorine.

This gas is also used as an aërial disinfectant. It is most simply used by pouring 6 oz. of strong sulphuric acid upon 1½ lb. of chloride of lime per 1,000 cubic feet of space when a strong irritant gas is given off. This gas has a great bleaching power, and will remove the colour from woollen or cotton articles coming in contact with it.

It is not necessary to mention the other disinfectants (so called) of this class. They are all, practically speaking, useless as routine measures. In certain cases where a particular room or ward was specially infected, it might be useful to use this form of disinfectant, provided we could hermetically seal up the room. As a matter of fact, in Europe, this method of disinfection has been given up, especially in Germany and France. Formol is now much used as an aërial disinfectant.

DISINFECTION OF CLOTHES AND BEDDING.

In jails we have only to consider the disinfection of a patient's private or jail clothing and his blankets and sheets. All articles of little value should be burnt. This should certainly be done in case of cholera, small-pox and plague. For the disinfection of blankets, sheets and cotton and woollen clothing, the following method is easily carried out. Soak the articles to be disinfected for 24 hours in one of the following solutions, then boil for not less than 15 minutes (with water at the boiling point, 212°F.), and afterwards wash and dry.

Any of the following solutions will do :—

(1) Carbolic acid (5 per cent.) solution.
(2) Izal solution (5 per cent.).
*(3) Chloride of lime, 2 oz. to 1 gallon of water.
(4) Perchloride of mercury, 1 in 1,000, or in the solution given above (page 111).

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* Lime should not be used if any other disinfectant is available, as it spoils woollen and cotton clothing.

DISINFECTION OF WARDS AND FURNITURE.

After thorough ventilation with fresh air, all wood-work, furniture, tables, beds, etc., must be thoroughly scrubbed with any of the above disinfectant solutions, or the bedsteads, if iron, can be removed and a fire lit under them and afterwards repainted. The walls must be scraped and lime-washed. The floor, if of earth, must be scraped and relaid; if of stone or wood, it must be thoroughly scrubbed. Carbolic solution and soap can be applied to all articles of furniture.

DISINFECTION OF *Excreta.*

The bowel discharges and urine of all cases of cholera, dysentery, diarrhœa, and enteric fever should be received in vessels containing a liberal quantity of one of the above disinfectant solutions, and should be removed as soon as possible to the incinerator and there burned. All vomited matters must be treated in exactly the same way; also all discharges from the throat, nose and lungs of patients suffering from tuberculosis, small-pox, or measles should be received on pieces of rags, which should be burnt.

CHAPTER XVI.

NON-INFECTIVE DISEASES.

As in the case of infective diseases so also in regard to other diseases, there are none which are peculiar to jails. Mention will, therefore, be made of a few diseases only which are not uncommonly met with in jail. The most important of these is scurvy.

Scurvy.—Scorbutus or scurvy is characterised clinically by intense general debility; sponginess and swelling of the gums; ecchymoses closely resembling bruises about the legs and thighs; a brawny hardness about the flexures of the larger joints, pearly conjunctivæ and a sallow aspect, somewhat akin to mild jaundice (Quain). In former times his disease was very common in prisons and among crews of sailing ships. The great cause of scurvy is a deficiency of fresh food. Fresh vegetables and fresh meat contain certain salts which are indispensable to health, and when these articles are withheld from a dietary health must suffer. That a strong scorbutic taint underlies much of the cachectic disease seen in jails is an old and at one time widely prevalent belief. This belief was based upon the supposition that the spongy blue-black condition of the gums, which is frequently found at unhealthy seasons among prisoners associated with anæmia and other symptoms is of scorbutic nature. The present writer, however, in common with nearly all medical officers in Bengal* who have commented upon these appearances, does not believe that they have any connection with scurvy, but that they are due to malaria, that is, to the debilitating effects of repeated attacks of fever and to neglect of the teeth.

The following are among my reasons for this belief :—

(1) The failure of special treatment by lime juice to remove this condition among prisoners.

(2) The appearance of these symptoms coincides with the most malarious portion of the year (*i.e.*, end of rainy season).

(3) The frequent history of repeated attacks of malarial fever.

(4) True scorbutic symptoms (effusions and ecchymoses of blood) are very seldom seen among such cases in jails.

(5) In malarious years this condition is frequent; in healthy years it is absent.

(6) In jails, where undoubtedly a good and sufficient quantity of fresh vegetables has been issued and in which fresh meat was also frequently given, yet this condition has appeared in malarious years.

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* A *résumé* of the opinions of medical officers on malaria and scurvy is given in Bengal Jail Administration Report for 1894.

(7) Very many cases in jails of *so-called* scurvy are really *pyorrhœa alveolaris*, due to dirt and neglect of the teeth. The use of tooth sticks should be encouraged.

Therefore, though it is the present writer's opinion that this condition is (apart from dirt and neglect of the teeth) malarious rather than scorbutic, yet this is not meant to detract from the paramount importance of providing a sufficient quantity of fresh vegetables of good quality daily. Should symptoms, which appear to be scurvy, appear, it is necessary to issue potatoes, onions or fresh meat in liberal amount daily. There are no better antiscorbutic vegetables than these in existence, but they must be given freely if they are to do any good. At the same time, those prisoners who show the most pronounced symptoms of scurvy must be placed in a special gang and paraded every day for a ration of lime-juice (1 oz. with sugar or *gur*), and at the same time animal food in the form of meat, milk or *dahi* should be issued in lieu of part of the daily ration of *dâl.* Great attention must also be paid to variety in food and to good cooking. Potatoes and spices in the form of *bhurtha* are very useful at such times.

The latest theory of scurvy, based upon experiments and the experiences of Arctic voyagers, is that scurvy is a form of ptomaine poisoning, produced by eating tainted meat, that is, meat preserved in tins, &c., which is not fresh. This certainly seems to explain scurvy in Arctic expeditions and in beseiged towns, but it will scarcely explain the occurrence of "land scurvy" among vegetable-feeders, like Natives of India, nor will it explain the existence of scurvy in some Indian jails. Personally I doubt if scurvy really exists to any important extent in Bengal jails. We, however, read much about its existence in jails of the Central Provinces and the Punjab. Ptomaine poisoning from tainted meat will not explain scurvy in India (see *Lancet*, April 28, 1900, page 1184).

CHAPTER XVI.

ANÆMIA.

Although anæmia is not strictly speaking a disease, but only a symptom of many diseased conditions, yet, as it is a symptom of frequent occurrence among prisoners, it should be briefly discussed here.

Anæmia may be due to the following causes :—

(1) Attacks of malarious fevers and their sequelæ.
(2) Previous attacks of dysentery.
(3) Organic disease, as tubercle of lungs, syphilis, or kidney disease.
(4) Exhausting or profuse discharges of blood or of pus.
(5) Lead and other metallic poisoning (unknown in Bengal jails).
(6) Parasitic anæmia, due to the sucking of the blood by an intestinal worm called *anchylostoma duodenale.*

As regards prisoners in jails, the first two of the above causes are the most important. It is not necessary to dwell upon this matter further in this place, but an account must be given of parasitic anæmia, because in the first place the condition is more common than is generally supposed, and, secondly, there is too little account given of the parasite in the ordinary text-books.

The parasite which is called *anchylostoma duodenale* (*or dochmius duodenalis*) is very prevalent in many districts of Bengal, Madras, North-Western Provinces, and Assam. It is also well known in Ceylon, Brazil, Egypt, Java, and many other places.

It is a small thread-like worm which fastens on to the mucous membrane of the duodenum or ileum. The intestine may harbour only a few, and the symptoms will pass unnoticed, or several hundred or thousand worms may be present, and this large and regular drain of blood must seriously affect the patient's health, producing intense anæmia, œdema, dropsy, etc., etc.

The ova or eggs of this worm are passed in thousands in the stools of patients suffering from the disease, and in villages where no proper latrines exist, the mud, and possibly the water, becomes infected with these ova which easily find their way into the patient's mouth, and thus into the duodenum, where they live upon the blood.

This disease or condition, called *anchylostomiasis*, is very common among coolies recruited for labour in Assam. It is very common among them in Assam, and in very many cases the parasite is found in patients before they reach Assam. Consequently, they must have brought the parasite with them. The disease has not been as much looked for as it should be in jails, but it should always be borne in mind as a cause of anæmia among newly-admitted prisoners. The diagnosis is made by finding the parasite. This can be done by examining a small bit of fœcal matter under the microscope. If present, the ova are easily seen. They can only be mistaken for the ova of other parasites.

To find the worm itself in the stools a somewhat more troublesome process is needed. Place some of the suspected fœces upon a piece of muslin over any earthen vessel; pour water freely upon it for about an hour till all fœcal matter has strained through the cloth. This leaves only a small quantity of inoffensive matter. Put this in a flat glass vessel (say a finger-bowl), mix with clean water, stir with a stick, and the worms if present can be seen without difficulty.*

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* The researches of Dr. G. Giles have shown that in all probability the disease known in Assam as *kala azar* is merely due to the ravages of this worm *plus* malaria. Doctor L. Rogers' report on this subject has just been published (1897).

Dr. Rogers endeavours to show that *kala azar* is only an intense form of malarial cachexia like the old Burdwan fever. This view is plausible, but will not be accepted by those who know the terrible ravages produced by this parasite in Ceylon, Egypt and many other countries. Major R. Ross's report supports Rogers in showing that much of what is called *kala azar* is due to malaria, but the evil effect of the blood-sucking intestinal worm must not be overlooked.

TREATMENT OF PARASITIC ANÆMIA.

These cases can be cured if seen early, but the mere expulsion of the parasite will not always cure the cachectic condition into which the patient may have fallen. The parasite is expelled in much the same way as is done in the case of other intestinal worms, but there are two drugs which have been very successfully used for this purpose, viz., thymol and male fern (*Filix mas*). First having emptied the bowels by a dose of castor oil, thymol, grs. 30 (finely powdered), is given in the early morning, to be followed after two hours by another dose of grs. 30. Or liquid extract of male fern in doses of 1 to 2 drs. may be given. In giving thymol care should be taken to see that it is very finely powdered, and also no alcoholic stimulant should be administered after thymol, as alcohol dissolves the drug and serious symptoms of thymol poisoning may result. After giving the above drugs all the stools must be examined for the next three days, and if no parasite be detected, the drug should be repeated after the interval of a week.*

CHAPTER XVII.

MALINGERING AND SELF-INDUCED DISEASE.

No account of the diseases of prisoners can omit a few remarks upon malingering and the self-production of disease. This is done to escape work and with the expectation of enjoying ease and rest in hospital.

In no part of his work will the experience and tact of the Medical Subordinate be more displayed than in the successful management of such cases.

It is a characteristic of prisoners all the world over that they will put themselves to great pain, even to the risk of their lives, to escape from the monotony and routine of enforced labour. There is an innate disinclination to work in the hearts of all habitual offenders. It is due to this that they took to habits of theft: consqeuently it is the duty of the Medical Subordinate of a jail to see that the privileges of hospital are not abused.

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* It is probable that intestinal worms are responsible for more cases of bowel-complaints than they are usually given credit for.

The most common complaint which is self-induced by prisoners is diarrhœa. This can be produced by use of various chemicals and dyes stolen from the workshops, by croton or castor-oil seeds, or by the oil itself when it is a jail industry. *Sujjumatti*, gravel, ground glass, *surki*, etc., are also used in some cases. The eating of raw grain sometimes causes a very severe form of diarrhœa or even enteritis. Prisoners employed in the garden have access to raw vegetables, unripe or over-ripe fruits, etc.

Malingering.—This usually takes the form of false complaints of disease. This can usually be detected by detention of the prisoner in cells under medical observation for a day or so. Rheumatism and lumbago are often feigned, and are very difficult to detect. Fits of epilepsy* are also sometimes feigned. The question of feigned lunacy is discussed below (page 123).

Ulcers and sores are also either caused or greatly aggravated by prisoners, especially by prisoners wearing fetters for any cause.

A word of caution is here necessary. An inexperienced Medical Subordinate is apt to consider that malingering and self-induced disease is more common than it really is. He must be very certain of the facts of the case before he reports a prisoner as malingering. Where he suspects this to be the case, he must consult the Medical Officer.†

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* True epilepsy is also found, but in my experience in large central jails in Bengal only to the extent of about one case per every 200 prisoners (·5 per cent.).

† It is said that fever can be produced by the application of onion or garlic to the skin.

CHAPTER XVIII.

THE MANAGEMENT OF LUNATICS IN JAIL.

LUNATICS or suspected lunatics are found in jail under five different classes of conditions :—

(1) Persons who have not committed a crime, but who are suspected to be lunatics and are placed under medical observation. (These are non-criminal lunatics.)

(2) Persons accused of a crime and supposed to be of unsound mind and placed under medical observation.

(3) Persons accused of a crime and found incapable of making their defence owing to unsoundness of mind, and detained under section 466 of Criminal Procedure Code, pending the orders of or at the pleasure of Government.

(4) Persons who have committed a crime and have been acquitted on the ground of having been insane at the time the crime was committed, detained under section 471 of Criminal Procedure Code, pending the orders or at the pleasure of Government.

(5) Prisoners who have become insane after their conviction and admission to jail.

The latter four classes are called "criminal lunatics."

The maximum period during which a non-criminal lunatic can be detained for medical observation is supposed to be 10 days.

Whenever a lunatic is found to be dangerous, noisy or filthy in habits, he should be confined in a cell, otherwise he may be detained either in a jail hospital or in an under-trial ward. The jail hospital will usually be found most convenient, as it affords the greatest opportunities for quietly studying the demeanour of the real or alleged lunatic. Lunatics usually receive ordinary jail food unless the

Medical Officer directs otherwise. It is necessary for the Medical Subordinate to pay special attention to lunatics, as the Medical Officer has to rely upon his reports as well as upon his own observations in drawing up the certificate of insanity.

The following is from the form prescribed for a certificate of lunacy:—

(1) Under the heading "Facts observed by myself" should be stated:—

- (*a*) What the appearance of the alleged lunatic is.
- (*b*) What he says.
- (*c*) What he does.

(2) Under the heading "Facts communicated to me by others" state what one is told by others as to the lunatic's sayings or doings.

(3) Under the heading "General appearance of the patient" note—

- (*a*) any cranial or other deformity;
- (*b*) his facial expression and gestures;
- (*c*) peculiarities of dress and gait.

As regards his bodily health—

- (*a*) the condition of his appetite and digestion;
- (*b*) the condition of his skin (if harsh, dry, etc.);
- (*c*) his pulse and temperature;
- (*d*) the presence or absence of insomnia, excitement, depression, defects of speech, etc.

(4) As regards his history.

As indicative of the cause, note (*i*) the presence or absence of any congenital defect; (*ii*) his heredity (any of his family affected); (*iii*) any indulgence in intoxicants *ganja*, alcohol, opium); (*iv*) epilepsy or any brain disease or any old or recent fracture of the skull or such injury; (*v*) disorder of the sexual organs—in females, pregnancy or recent parturition; in males, masturbation or a history of excessive sexual indulgence; (*vi*) any mental worry or overwork; (*vii*) any sudden shock.

(5) Inferences as to his mental condition and capacity are drawn from (*i*) the patient's answers to ordinary questions; (*ii*) from his acts; (*iii*) his writing (if he can write); (*iv*) his memory for past events in his own life; (*v*) his judgment; see, for example, if he knows the value of money; (*vi*) the existence of delusions; (*vii*) from his power of fixing his attention when being asked questions.

FEIGNED INSANITY.

It frequently becomes necessary to distinguish between true and feigned insanity. Such cases frequently require prolonged and careful observation.

The chief points to be noted are—

(1) The absence of a characteristic facial expression, or if present, it is not persistent.

(2) The absence of bodily disorder; the person feigning insanity probably sleeps well. Deafness or dimness of vision may be feigned.

(3) Feigned insanity often appears suddenly and often may be traced to a desire to escape some form of punishment or work.

(4) Want of unformity in the symptoms. The impostor usually mixes up several types of insanity—mania, dementia or melancholia.

(5) Persistent obtrusion of symptoms. The impostor generally overacts his part, especially when he knows that he is being observed.

DIFFERENT FORMS OF INSANITY.

Mania is probably the commonest form of mental derangement found in jails. Melancholia is not infrequent; but as the sufferers are usually quiet and well disposed, they are not so often sent to prisons or asylums. In these cases the danger of suicide must always be remembered. Epileptics are often lunatics as well. There are usually a few epileptics in all large jails. If a prisoner is known to be an epileptic, he should be kept under observation for some time and always detained in hospital for several days after an attack. He should also not be allowed to work in any place where there is machinery. Persons mentally feeble or imbecile are not uncommon in all jails. They are generally harmless, but care should be taken of them, as other prisoners are apt to torment them or excite them to commit breaches of discipline. The Medical Subordinate should know all such by sight, and a note of their condition should be made upon their history ticket.

In the treatment of mania the less restraint it is possible to use, the better. Fetters, handcuffs, etc., are usually inadvisable. Active bodily exercise, such as walking round the jail enclosures every morning and evening, is useful. Cases of acute mania or intoxication from excessive use of *ganja* or other forms of *Cannabis Indica* are also met with in jails. They are usually curable, but need care and attention.

CHAPTER XIX.

POST-MORTEM EXAMINATIONS.

EXCEPT during a severe outbreak of cholera, it is advisable to make a *post-mortem* examination upon the body of every prisoner who dies in jail.

The following will be found a good method of performing the examination:—

As the body lies upon the *post-mortem* table, first examine the surface of the body for external injuries, wounds or other marks of violence. The condition of the body as regards emaciation, etc., should be noted.

The head.—This need only be examined when the cause of death is doubtful or when the patient has died of some brain disease or injury.

Make an incision down to the bone from ear to ear, reflect the scalp backwards and forwards. Saw through the skull at a level of one inch above the orbit in front and of the occipital protuberance behind. Raise the skull cap. Divide and reflect the *dura mater* close to the large vein in the middle line. Look for signs of inflammation and for adhesions. Carefully remove the brain from in front backwards, cutting the nerves, etc., as they appear. Place the brain on the table. Cut it in slices horizontally from above. Open up the lateral ventricles, look for collections of serum or for blood clots. Examine the cerebellum. Strip off the *dura mater* from the base of skull; look for fractures or disease of internal ears.

Thorax.—Make an incision in the middle line from the chin to the pubis. Reflect the skin and muscles of chest. Note if fluid is present in the abdominal cavity. Remove the sternum and cartilages of ribs. Note appearance of lungs and heart. Open the pericardium. Note the amount and nature of any fluid without removing the heart. Open and examine the cavities in the following order—right ventricle, right auricle, left auricle, left ventricle. Note contents. Remove lungs and heart together. Again examine the heart; note the condition of the valves. Make long incisions into the lungs; open up bronchi. Note condition of the apices. If necessary, remove and examine trachea, larynx, and tongue.

Abdomen.—First examine organs *in situ*. In cases of suspected poisoning remove stomach after trying both cardiac and pyloric ends. Preserve contents if necessary. Remove liver, weigh; make incisions. Examine gall bladder, spleen; note size, marks of injury, weigh. Examine bladder, and in females the uterus and ovaries. Examine the kidneys.

Intestines.—Look for signs of peritonitis, fluid, etc. Remove, lay open, wash; note condition of mucous membrane; look for entozoa (worms), signs of perforation, ulceration, especially in ileum, large intestine, and appendix.

The spine and spinal cord need only be opened in special cases. To do this, divide the skin in the middle line of the back. Saw through the vertebral arches on both sides. Examine condition of *dura mater* and cord.

Weight of organs.

The following tables give the average weights of organs of the human body:—

Average weights of adult viscera (Tidy)—

		Europeans.	
		Male.	Female.
Brain	...	49½ oz.	44 oz.
Lungs	...	45 ,,	32 ,,
Heart	...	9½ ,,	8¾ ,,
Stomach	...	4½ ,,	4 ,,
Liver	...	50 to 60 ,,	45 to 55 ,,
Spleen	...	5 to 7 ,,	5 to 7 ,,
Pancreas	...	2 to 3 ,,	2 to 3 ,,
Kidneys (both)	...	9 ,,	8½ ,,

The following table, compiled by Babu Bela Ram, Rai Bahadur, of the Medical College, Lahore, gives recorded weights for the viscera of Punjabis:—

		Male.	Female.
Brain	...	44 oz.	40 oz.
Heart	...	7 ,,	6·2 ,,
Lungs	Right	20·6 ,,	15·9 ,,
	Left	14·6 ,,	13·2 ,,
Liver	...	46 ,,	40 ,,
Spleen	...	17 ,,	13·2 ,,
Kidney	Right	4·2 ,,	3·7 ,,
	Left	4·3 ,,	3·7 ,,

APPENDICES.

APPENDIX I.

HOW TO GIVE CHLOROFORM.*

By Lieut.-Colonel E. LAWRIE, M.B., *Edinburgh*,
Indian Medical Service.

Syme's Principles.

To give chloroform with uniform safety it is essential to follow the principles of Syme. In accordance with these principles, the points which are of the greatest importance are, first, a free admixture of air with the vapour of the chloroform, to ensure which a soft porous cap or cone into the apex of which a little absorbent cotton is stitched, is employed. Secondly, if this is attended to, in such a way that the patient can breathe without any distress or choking, the more rapidly the chloroform is given, the better till anæsthesia is produced. Then—and this is the all-important point—the chloroformist must be guided as to the effect not by the pulse or the circulation, but entirely by the respiration; no one should ever have his finger on the pulse while chloroform is given. If the chloroformist thinks it necessary at any time to examine the pulse in order to find out how the patient is bearing the inhalation or the operation, the adminstration should invariably be stopped while the examination is being made. No special apparatus is required. The dose can be regulated only by regular normal breathing, which it is the one duty of the chloroformist to maintain, whether an apparatus is used or not, throughout the administration. Lastly, the anæsthesia should never be pushed beyond the point when the patient is fully under the influence of the anæsthetic.

Additional points of detail to be attended to.

2. Two or three assistants should always be present when chloroform is given; in a certain percentage of cases it produces excitement and intoxication, and in this state the patient may struggle so violently as to become unmanageable if sufficient assistance is not available. All

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[*] See also article by Lt.-Col. E. Lawrie, I.M.S., in *Indian Medical Gazette*, June 1900.

the assistants need not be skilled, but they should thoroughly understand how to control the patient if necessity arises. No preparation of the patient is required. It is advisable not to permit any solid food to be taken for three or four hours before an operation under chloroform, since full doses of the drug are apt to induce vomiting either at the time or afterwards. If the operation is likely to be prolonged, a quarter of a grain of morphine may advantageously be given subcutaneously fifteen minutes before the inhalation is commenced; or if the patient is very weak or nervous, some diffusible or alcoholic stimulant may be allowed, though as a general rule it is better to do without it. Everything about the patient's neck, chest, and waist must be loose, and the lower part of the chest should, if possible, be exposed in order that the chloroformist may see the movements of respiration all the time the inhalation is going on. The choloroform should be given in one drachm doses applied to the cotton wool inside the cap at intervals of a minute until anæsthesia is complete; or in the case of children in half-drachm doses after the first dose; and every time a fresh dose is added, the surgeon should make sure that the patient takes at least one breath of pure air before the cap is reapplied. In midwifery when chloroform is employed to assuage the pains of labour, it should be given in a ten-drop dose with each pain, and none should be given in the intervals. For midwifery operations it should be used in the ordinary way. In dentistry partial or complete anæsthesia can be employed. If complete anæsthesia is necessary in tooth extraction, the patient should first be deeply anæsthetised, and the dentist should then wait for a few seconds until the deep anæsthesia just begins to pass off. If tooth extraction is begun before the patient is fully anæsthetised, there is almost sure to be reflex struggling or emotional expression: if it is carried out during deep anæsthesia, there is some danger to the respiration in the process; but neither of these untoward events occurs when the extraction is done as the anæsthesia is passing off. While the teeth are being extracted it is the chloroformist's duty to keep the lower jaw pushed well forward, in order to prevent the operation or the manipulations from interfering with the breathing.

The management of each stage of chloroform anæsthesia.

3. The administration of chloroform should be begun by the application of the cap containing a drachm of chloroform gently over the mouth and nose, the mouth being covered in first and then the nose. The cap should then be held with the apex vertically upwards, so that

the heavy vapour of the chloroform falls straight down on to the nose and mouth. The stages of the administration will be found to divide themselves as follows :—

Stage 1.—There is some difficulty in getting the patient to breathe regularly, and there may be resistance either from fright or from choking.
Stage 2.—Unconsciousness supervenes.
Stage 3.—Struggling generally occurs.
Stage 4.—Anæsthesia is complete :—either the cornca becomes insensitive or the breathing stertorous.

It is the chloroformist's business to ensure normal breathing and never to allow it to be intefered with in any way while chloroform is given. During the first stage of the inhalation this is done in one of three ways. (1) Adults should be told to breathe quietly and regularly. (2) If from any cause they cannot do so, they must be made to blow into the cap after each breath. After each "blow" they are sure to take a breath and this makes the respiration absolutely regular. (3) Young children scream and cry when chloroform is placed near the face, and as crying ensures a perfectly regular and safe inhalation, just as blowing into the cap does in adults, the cap should be held close down over the mouth and nose from the commencement in children in order to make them cry until they become unconscious and breathe quietly, when the administration may be continued in the ordinary way. A great deal depends upon the management of this stage of the administration. If the patient breathes regularly and quietly at first, the whole inhalation will generally be quiet and normal, whereas if at the beginning he is made, or allowed, to resist and choke and hold his breath, the inhalation will most likely be abnormal and irregular throughout. It is dangerous to try and make the patient breathe regularly by telling him to count while he is taking chloroform. He may count up to 20 or 25 without taking a breath, and then gasp in an overdose.

During the second stage, when unconsciousness supervenes, which it usually does after the inhalation of a drachm or two drachms of chloroform, the patient often breathes irregularly; he may hold his breath, or there may be forced or noisy expirations. The cap must be kept close enough to the face to determine anæsthesia; its upper rim resting on the bridge of the nose, while as much or as little air as the administrator likes can be given by raising or letting down the rim below the chin.

Directly the patient is unconscious and no longer answers to his name minor operations of short duration may be performed. Such operations as plunging the needle into the liver for aspiration, incising small abscesses and whitlows, the extraction of certain teeth, or snipping-off an external pile, may safely be done while the patient is in this stage; and though he may struggle or call out, he will not remember anything about it afterwards, nor will there be any vomiting. It is important to remember that this stage may not last for more than a few seconds, and may terminate either in struggling, or in full anæsthesia without struggling. Though an experienced chloroformist can generally tell by the breathing which of these events is about to supervene, it is well to test the sensibility of the cornea from time to time as the second stage progresses.

During the struggling stage the chloroformist must have all his wits about him to guard against overdosing from gasping or irregular breathing and an irregular intake of chloroform. There is only one way of making absolutely certain about this point, and that is *to remove the cap entirely away from the patient's face when he begins to struggle*—and again from time to time as long as the struggling stage lasts—*and give him two or three full breaths of pure air.* This does not delay the anæsthesia; it very often stops or cuts short the struggles, and it ensures the safety of the patient. The struggling stage ends by the patient becoming quiet, snoring, and passing gradually or rapidly into the stage of full anæsthesia. As the struggling stage is ending, the chloroformist must keep on testing the cornea, and if he is at all uncertain about its condition, he must take away the cap until the doubt is removed.

Full anæsthesia is indicated either by abolition of the corneal reflex—winking no longer occurring when the eyelid is raised or the eye touched by the finger—or by stertorous breathing. As soon as the cornea is insensitive, the administration must cease until more chloroform is required to maintain the anæsthesia at the normal level. On the other hand, *if stertor is the first sign of anæsthesia, the cap should be removed forthwith without waiting for the corneal sign*, as the cornea always becomes insensitive in a few seconds after the breathing becomes stertorous, without any further inhalation of chloroform. After anæsthesia is complete it must be maintained at the normal level by giving more chloroform from time to time as often as the surgeon or the chloroformist considers it advisable. Lastly, when the operation is finished the patient should on no account be removed from the operating table until he has shown unmistakable signs of returning consciousness. As far as the chloroform is concerned, he is then, but not till then, safe.

Necessity of concentrating the attention entirely on the breathing.

4. The chloroformist who wishes to give chloroform safely on Syme's plan must never allow his attention to be distracted from the patient's breathing in any way whatsoever throughout the entire administration. This rule is so imperative that there must be no feeling of the pulse nor even any wiping of the patient's mouth while the anæsthetic is being given; if the chloroformist wishes to do anything of the kind, or if it is desired to alter the position of the patient or of the operating table, he is bound to remove the cap and stop the administration during the whole time it is being done. Further, chloroform should not be pushed in any case where the patient's breathing is already embarrassed by disease or is likely to be so by the operation. It ought never to be given in tracheotomy except for the purpose of momentarily distracting the patient's attention while the first incision is being made; and only very sparingly in such cases as empyema, or in any case where the circulation is weakened by respiratory affections or derangement. Finally, *it is not right under any circumstances to keep the patient's lower jaw pushed forward* for the purpose of warding off stertor *during the administration of chloroform;* it prevents stertor, but, paradoxical as it may seem, it conduces to overdosing. Stertorous breathing is one of the two workable signs of anæsthesia, and it is no less dangerous for the chloroformist to deprive himself of a sign which is of such supreme importance than it would be to deprive himself of the other sign of anæsthesia, viz., the abolition of the corneal reflex, by covering up the patient's eyes during the inhalation.

The treatment of accidental overdosing.

5. Unless the above rules are accidentally disregarded, overdosing and death under chloroform will not occur. But if accidental overdosing does take place, and the breathing becomes seriously embarrassed or stops, the lower jaw should immediately be pushed or pulled forward by the chloroformist, and he should also draw out the tongue with catch forceps. This will generally restore natural breathing. If it does not, artificial respiration should be performed in addition without an instant's delay by a modification of Howard's method, a few drops of nitrite of amyl being poured on to a handkerchief or cloth and held in front of the patient's nose and mouth while it is continued. The easiest and most effectual way of performing Howard's method of artificial respiration,

so as to admit of the other measures being carried on without interruption at the same time, is for the surgeon himself to get on to the operating table or couch, and kneeling astraddle the patient, alternately compress and relax the chest and diaphragm. It is an invaluable plan for anyone who has to teach students how to give chloroform to hold frequent demonstrations of overdosing in the dog, and exercise them in the needful measures of restoration until they know exactly how to act in similar cases of accidental emergency in the human subject.

APPENDIX II.

MEASUREMENT OF SPACE.

The following formulæ are given to enable the Medical Subordinate to correctly estimate the amount of cubic air-space, etc., in a building of whatever shape:—

To measure cubic space.

In a square or oblong room the three dimensions of height, length and breadth are sufficient, *e.g.*, a ward is 50 feet long, 12 feet high, and 18 feet broad. The cubic air-space is $50 \times 12 \times 18 = 10,800$; so that if 20 men inhabit this ward, the cubic air-space per man is $\frac{10800}{20}$ = 540 cubic feet.

But all buildings are not of this simple shape. It is therefore necessary to be able to measure them also. In this case the rules for measurements of triangles, segments of circles, etc., must be used.

The area of a circle $= D^2 \times \cdot 7854$, that is, the diameter squared and multiplied by ·7854.

Area of a square = multiply any two sides into each other.

Area of a rectangle = multiply any two sides (which are perpendicular to each other) together.

Area of a triangle = base multiplied by half the height.

Cubic capacity of a solid rectangle = multiply the three dimensions—length, breadth, and height.

Cubic capacity of a solid triangle = area of the triangle multiplied by the depth.

Cubic capacity of a cylinder = area of the base multiplied by the height.

For example, the cubic capacity of a ward with a gable roof

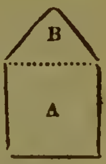

Fig. 1.

To find this, first find the area of rectangle A, and next the area of the solid triangle B, and add them together, *e.g*, suppose the ward to be shaped as in figure 1; let the sides of the rectangle be 50′ × 18′ × 12′ = 10,800 c. ft., and the measurements of the triangle above be 18 × 50 × 6. Then, as the area of a solid triangle is the area of the triangle multiplied by its depth, the area in this case (= base multiplied by half height) is 18 × 3, or 54. This 54 multiplied by 50 (the depth) is 2,700. Add this to 10,800, and the cubic capacity of the ward is 10,800 + 2,700, or 13,500.

Of course, to estimate accurately the exact amount of cubic space per man in an inhabited room, deductions must be made for furniture, beds and also 3 cubic feet must be deducted for the space occupied by the individual himself. As a general rule, it may be stated that heights above 12 feet are not counted as air-space; therefore if a room be over 12 feet high, it is sufficient to calculate the air-space as if it were merely 12 feet high.

METRICAL WEIGHTS AND MEASURES.

As these are frequently made use of, it is necessary to mention the most important here:—

Measures of length.

1 metre	...	=	39·37	inches.
"	...	=	3·28	feet.
"	...	=	1·09	yard.
1 centimetre	...	=	·039	inches.
"	...	=	·003	feet.
1 kilometre	...	=	1093·	yards.
"	...	=	·621	mile.

Measures of capacity.

1 cubic centimetre	...	=	·06	cubic inch.
		=	·001	pint.
1 litre ...	...	=	61	cubic inches
		=	1·76	pints.
		=	·220	gallons.

Measures of weight.

1 gramme	...	=	15·43	grs.
1 kilogramme	...	=	2·2	lb. avoir.

also

Ten centimetres in length = approximately 4 inches.

APPENDIX III.

LIST OF RETURNS AND REPORTS TO BE SUBMITTED FROM A JAIL HOSPITAL.

No.	NAME.	To whom sent.	Date of sending.
1	2	3	4
...	Annual Indent for Medical stores.	Inspector-General of Jails.	8th January.
5	Annual Medical Return (duplicate).	Ditto ...	15th January.
...	Sanitary Report ...	Ditto ...	30th January.
4	Monthly Medical Return (duplicate).	Ditto ...	Before 5th of each month.

APPENDIX IV.

Table to calculate equivalents of weights, volume, length, etc.

To convert	grammes	to	grains	multiply by ...	15·43
,, ,,	grains	,,	grammes	,, ,, ...	0·064
,, ,,	litres	,,	gallons	,, ,, ...	0·22
,, ,,	litres	,,	pints	,, ,, ...	1·76
,, ,,	litres	,,	cubic feet	,, ,, ...	0·354
,, ,,	gallons	,,	cubic feet	,, ,, ...	0·160
,, ,,	gallons	,,	litres	,, ,, ...	4·543
,, ,,	pints	,,	litres	,, ,, ...	0·567
,, ,,	cubic metres	,,	gallons	,, ,, ...	0·0036
,, ,,	cubic metres	,,	pints	,, ,, ...	0·0288
,, ,,	cubic feet	,,	cubic metres	,, ,, ...	0·0283
,, ,,	cubic feet	,,	litres	,, ,, ...	28·21
,, ,,	cubic feet	,,	gallons	,, ,, ...	6·23
,, ,,	fluid ounces	,,	cubic inches	,, ,, ...	1·72
,, ,,	fluid ounces	,,	cub. centimetres	,, ,, ...	28·35
,, ,,	square feet	,,	square metres	,, ,, ...	0·092
,, ,,	square feet	,,	square yard	,, ,, ...	0·111
,, ,,	square metres	,,	square feet	,, ,, ...	10·76
,, ,,	inches	,,	millimetres	,, ,, ...	25·4
,, ,,	kilometres	,,	miles	,, ,, ...	1·6

APPENDIX V.

Table of relative heights and weights of Bengal prisoners.

(*Vide* page 2 above.)

The following table, already published by me, gives the results of my collection of 28,863 heights and weights of prisoners in Bengal jails. As will be seen, column 2 (weight) closely corresponds to a formula I published some time ago, which is very easily remembered.

Taking 100 lbs. as equal to 5 feet, for every full inch above 5 feet add 3 lbs., *e.g.*, 5 feet 5 inches = 115 lbs., etc.

TABLE.

Height.	Weight.	No. of observations.	Percentage.
1		2	3
5'	100	1,863	6·5 per cent.
5' 1"	102	2,069	7·2 ,,
5' 2"	106	5,226	18 ,,
5' 3"	109	5,787	20 ,,
5' 4"	112	6,107	21 ,,
5' 5"	115	3,040	10 ,,
5' 6"	118	2,498	8·7 ,,
5' 7"	121	1,389	4·8 ,,
5' 8"	125	623	2·1 ,,
5' 9"	129	220	·7 ,,
upwards	134	51	
		Total 28,863	

Vide Indian Medical Gazette, October 1897, and *Lancet*, 4th September 1897.

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MANUAL OF JAIL HYGIENE.

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MEDICAL SUBORDINATES,

BY

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